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The Outlook

"I Have Nothing Against It"

"IF the British aeroplanes fly at a tremendous height at night and drop their ridiculous propaganda on German territory, I have nothing against it." Thus Field Marshal Goering in his broadcast last Saturday.

Has a more humiliating admission, we wonder, ever been made by the head of a great air corps? Five times in the first week of the war have British aeroplanes flown at their own sweet will over western and northern Germany, dropping millions of propaganda leaflets, and the German air defences have not been able to interfere with them. Field Marshal Goering, in his own words, has literally "nothing against it." To millions of Germans it has been demonstrated in the most emphatic manner that their air defences are powerless to prevent the entry and exit of British machines over their country. Every German who has picked up one of these leaflets must have realised that the British were in a position to drop bombs if it had been their intention to do so, and all the comfort that the boastful chief of their own air corps has been able to say is that he has nothing against it, but that if bombs are dropped he will retaliate. That is very cold comfort for the German citizen who has been told over and over again that the air defences of his country are impregnable. Even if, on some later occasion, the German defences are more successful in interfering with British machines, that will not alter the fact of the great success we have achieved in the first week of the war.

Two Tragedies

THE German chagrin at the failure of their own attempts to intercept the British aircraft must be increased by the success of the Belgian fighters who did intercept them. In the midst of a tragedy which every Briton deeply regrets, there is a feeling of satisfaction at the efficiency of the Belgian air corps, which has had such a long and friendly connection with British aircraft manufacturers.

It goes without saying that it was only by an unfortunate error that some British machines flew over Belgian territory, and there is not the slightest doubt that the Belgians were absolutely right in attacking them. The Dutch were also quite right to fire at belligerent machines which were observed over their territory, though it seems doubtful to which side those machines belonged. Neutrals are obliged by international law to take such action against belligerents of either side who violate their territory, even by mistake.

It is not surprising that the British crews over Belgium did not recognise their assailants and defended themselves. The wounding of two Belgian airmen is a tragedy which fills us with sorrow. The Germans will doubtless note that the gunners in our bombers can shoot straight.

Even more poignant is our regret for the loss of one life in Esbjerg, the port of our good friend and kinsman nation, Denmark. That little port has come into being solely for the sake of exporting Danish produce to Great Britain, and one member of the staff of *Flight* has warm recollections of hospitality received there during a recent visit. The bombs which fell there must have been dropped to lighten one of our bombers engaged in a death struggle from which it did not return, and the crew of which must have thought that they were over the open sea. Navigators cannot work with accuracy during such a fight. Such a tragedy is not likely to be repeated.

France's Effort

IT would be futile to expect as yet any detailed announcements of the French Army's operations as they fight their way forward in front of the West-wall, as the Germans now call the Siegfried Line. For

ANTI-SUBMARINE : Modern oversea reconnaissance aircraft acting in conjunction with Naval vessels are a strong deterrent to underwater craft operating within range of their aerodrome. Carrying special anti-submarine bombs they can patrol waters where submarines may be lurking, spot them and complete their destruction.

the moment the object of the Allies must be to bring relief to Poland by operations which will distract the Germans and lead to a movement of their forces from the eastern to the western front. This is reported to have begun already, for six divisions are stated to have been moved to the west. That is only a fraction of Germany's land forces, but the movement is a step in the desired direction and is doubtless only the first instalment. The roads at the rear of the line have been reported as crammed with German troops.

This has offered a grand opportunity to the French bombers, and they have seized it. In a land campaign one of the most useful tasks which a bomber force can undertake is to harass the movement of reinforcements up to the firing line—and with reinforcements are included supplies of food and ammunition and all the other impedimenta which are necessary to the fighting value of an army.

The reconnaissance machines of France have been sedulously photographing the German positions along the frontier, and no doubt the important railway points are well known to the French staff. The French aircraft have begun a heavy bombardment of these points, and will doubtless keep it up. Consequently the Germans may find that the reinforcing of the Westwall is not a simple operation.

As for the troops already in the line, few things are more disheartening to men in that position than to find their expected reliefs not arriving up to time. It is also depressing if the supplies of food and ammunition are not forthcoming.

Civil Air Lines in War

WHILE the last war did a great service by developing the flying machine as such, the present war is a serious interruption to the advance of civil air transport. The Empire air mail scheme is suspended, and no longer can letters be flown to Sydney and Durban at 1½d. the half ounce.

There still remain useful services which the air operating firms can render to the community in time of war, and we understand that they are organised to render them. In time of war, perhaps even more than in time of peace, there is need for rapid communications both inside the country and outside it. Just as Sir Neville Henderson used aircraft on his journeys between Germany and Great Britain during the final negotiations on the eve of war, so there must be special work for aircraft during the war. Rail services are being curtailed, and medical supplies, for instance, must sometimes be hurried to places where they are urgently needed.

As for overseas communications, though every confidence is felt that the Navy will keep the upper hand of the submarine menace, there will still be occasional danger in sea voyages. Representatives of the Allies must visit each other, and we do not desire a repetition of such tragedies as the sinking of the *Hampshire* with Lord Kitchener on board. Aircraft are immune from attacks by submarines and from collisions with mines, while the short-range fighters of the enemy could not reach them on the routes which they would follow.

Incidentally, it is almost amusing to note how Imperial Airways have been relieved of the "nightmare of the Christmas mail," which recently was so distressing to the minds of the company's directors.

Atlantic Air Services

IT might be argued that the paper read by Major R. H. Mayo to the British Association earlier this month is now of purely academic interest, as the development of trans-Atlantic air services is likely to be postponed for an indefinite period. That is not necessarily so, and problems of long-range flight with a "useful" load may very well assume an importance of a grimmer and urgent topical interest. But even if this were not so, the arguments set forth in the paper deserve to go on record. For the first time, it seems to us, the whole position of trans-Atlantic flight has been viewed as a whole, instead of piecemeal. As Major Mayo says, he has attempted to survey the wood which has too often been obscured by individual trees.

On the whole Major Mayo's arguments run along the same lines as these which we in *Flight* have used for some years. He pleads, as we have done, for the segregation of mails and passengers, and he, again in agreement with us, suggests that perhaps the logical development will be landplanes for the mails, flying boats for the passengers.

That Major Mayo will be accused of being prejudiced in favour of the composite aircraft may be taken for granted. But his arguments are logical, and his desire obviously is merely to assess as impartially as may be the pros and cons of the different forms of assisted take-off and other means of increasing range and cruising speed.

It has been pointed out repeatedly in these pages that there is no one scheme which can be said to show overwhelming advantages compared with the others for all purposes. One may form the most promising solution for one route and one class of work, another for a different route and different conditions. In other words, the future will probably show that "there is room for all."

Continued from August 31.

RAIDING by CELESTIAL NAVIGATION

Part IV : Final Corrections : Using the Datum-line Method : On the Target

By FRANCIS CHICHESTER

THE fourth and last of Mr. Chichester's series of articles (the previous one was published on August 31), this is by far the most important. As the author explains in the introduction, all previous work has been merely a preparation. Here the really critical and final work is explained.

For the benefit of those who have not read the three previous instalments this is the story of an imaginary raid carried out solely by celestial navigation. The special navigating machine and the two heavily loaded bombers are now approaching the target.

ALL the preceding navigation of this flight was only preparation for the precise work required at the end of it. For several hours the bombers have been navigating accurately, not merely with the object of knowing their position, but also to find out the change in wind coupled with any pilotage or instrumental errors. They now know what wind to expect at the end of the flight, can closely estimate their time of arrival, and can manœuvre on to the best course to carry out the rapid and essentially accurate navigation required at the end of the flight.

The critical navigation will take place about 50 miles from the objective. Here the bombers must be dead on their course and keep on it. Also they must know exactly how far they are from their objective and how many seconds of flight must elapse before beginning the descent. How can such precision be obtained, together with extraordinary rapidity of working? If the usual method (Running Fix) is employed of obtaining a position-line from one star, a second position-line from another star, and transferring the first position-line to allow for the distance flown during the interval between the two observations, there must be a delay of a few minutes between the moment of finishing the observations and obtaining the position information from them.

But the whole period of critical navigation will not exceed 20 minutes, and the length of time needed to get a Running Fix makes that method unsuitable for the accuracy required. There is another and greater objection to it—that it depends on the accuracy of two sets of observations and computations instead of on only one; I will refer to this later.

The navigators used what may be termed the Datum-line method. Briefly, this method is to fly down a predetermined datum-line, half an hour's flight in length—in this case about 100 nautical miles. This datum-line is such that a chosen star is bearing at right angles to it at the time the aeroplanes are about half-way along it. It is, therefore, a position line derived from the star at that time and passing through the objective. Observation of the star gives the machine's distance away from the datum line. This information is obtained immediately the observation is finished, without the necessity for any computing or plotting. The navigators will be able to ascertain how much off course they are as often as they care to observe the star. The result will depend on only one accuracy—that of the observation of the one star.

The bombers must aim to get on to a course such that Alioth is exactly on the beam of that course, i.e., at right angles to a line between the aeroplane and the objective when about 50 miles, or a quarter hour's flight, short of the objective; say, at point P. If slightly off course at that time, the position line obtained will be parallel to the line through the aircraft and the objective. The reason for this is that the star is bearing at right angles to the machine's flight direction. In other words, observation of one star will inform the navigators how much off course they are at the time. If the navigators know beforehand what the star's altitude will be, if observed from this datum line through the objective, they only need to compare the observed altitude with it in order to discover immediately by what distance they are off course.

Now as to the time of the observation. There can only be one moment when the star is dead abeam of the datum line, when observed from P on that line, but its position will change so little in azimuth for a short period before or after that moment that it can still be treated during that time as dead abeam. If, therefore, a graph is prepared beforehand giving the star's altitude as observed at P for any moment near the expected time of being at P, it will not matter if the navigators make their observations a little later or earlier than expected; they will only need to compare the observed altitude with the graph altitude for the same instant to tell how much off course they are then.

Practical Application

What will happen if they observe at the datum time but either have not reached P or have passed it? A star position-line is a line such that the altitude of the star will be the same from whatever point on the line it is observed at any given moment. If the star, for example, is directly above one of the poles of the earth and its altitude is 0 deg., the position-line will be a straight line—the Equator, in fact. If, however, the star's altitude is 89 deg., that is, within 1 deg. of directly overhead, the position-line will be a small circle of radius 1 deg. = 60 miles.

Obviously, therefore, the position-line is really a position-circle, but in practical flight navigation the radius is nearly always great enough for the circle to be assumed a straight line. In this case the curvature of the line is ½ mile in 50 miles, so that ¼′ is the greatest error that can occur due to curvature if the bombers are anything up to 50 miles short of P or beyond it at the datum time. If, therefore, the datum position-line is plotted on the chart and the star is observed at or near the datum time, the amount the aircraft are off-course, i.e., away from the datum line, can be told immediately after a glance at the altitude graph, no matter where they may be along the 100-mile datum line.

Now arises the question: What happens if the star is observed, say, a quarter of an hour before or after the datum time? In 15 minutes the star has changed position. First, in altitude; this altitude change is plotted on the graph, and navigators know that the graph altitude to be used for comparison with the observed altitude is the altitude shown for the moment of observation. Secondly, the star has changed position in azimuth. In this case, the amount of change in azimuth during fifteen minutes before or after the datum time is 2°.

Correspondingly, the position-line 15 minutes earlier will make an angle of 2° with the datum position-line.

In the accompanying diagram the star's altitude as observed from Q, 15 minutes before the datum time will not be the same as at P; but it will be the same at Q_1, or anywhere along Q_1 P. If, therefore, the star's altitude is observed when the planes are somewhere near Q, 15 minutes before the datum time, the observed altitude should not be compared with the graph altitude for that moment, because the latter is made up for the point P. The P (graph) altitude must first be corrected by the amount QQ_1:

QQ_1 = the distance of Q from P multiplied by sine $\angle QPQ_1$;

and QPQ_1 equals the change in azimuth of the star.

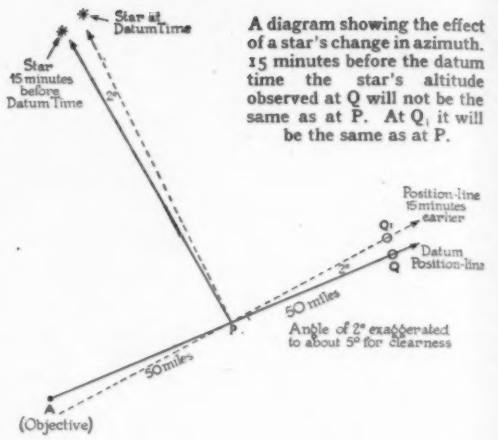
So we find that the datum line can be used for immediate course-correction at any moment within 15 minutes of the datum time and for anywhere within 50 miles of the datum point, provided two small corrections are made to the graph altitude for the moment of observation;

(1) *Deduction for position-line curvature.* The maximum correction is ¼ mile when 50 miles away from P. This correction can therefore be disregarded when within 40 miles of P.

(2) *Correction of the graph altitude for change in azimuth of the star.* The maximum correction for a moment 15 minutes from the datum time and 50 miles from the datum point will be 50 sin 2°, i.e., 1¾ miles. 20 miles from P, when the azimuth change is 1°, the correction will be ½ mile.

As this datum line and the altitude curve will be needed for fast accurate work when the bombers are within 20 miles of P and the change in azimuth is less than 1°, it can be seen that, even for the precise degree of navigation here demanded, the datum line and graph altitudes can be used then for immediate comparison with the observed altitude without any need for correction.

By this method the navigators will be able to tell how much off course they are immediately after each observation of the star, however rapidly observations are made. In order to obtain this information by the Running Fix method it would be necessary to take observations of two stars and transfer one of the position lines to allow for the distance flown between the observations. There would be a considerable amount of plotting to do. Far more important than this, the Running Fix method would depend on the accuracy of both observations and on the accuracy of transferring one of the position lines. By this method of flying along the datum line the accuracy of the result depends on the accuracy of only one observation.

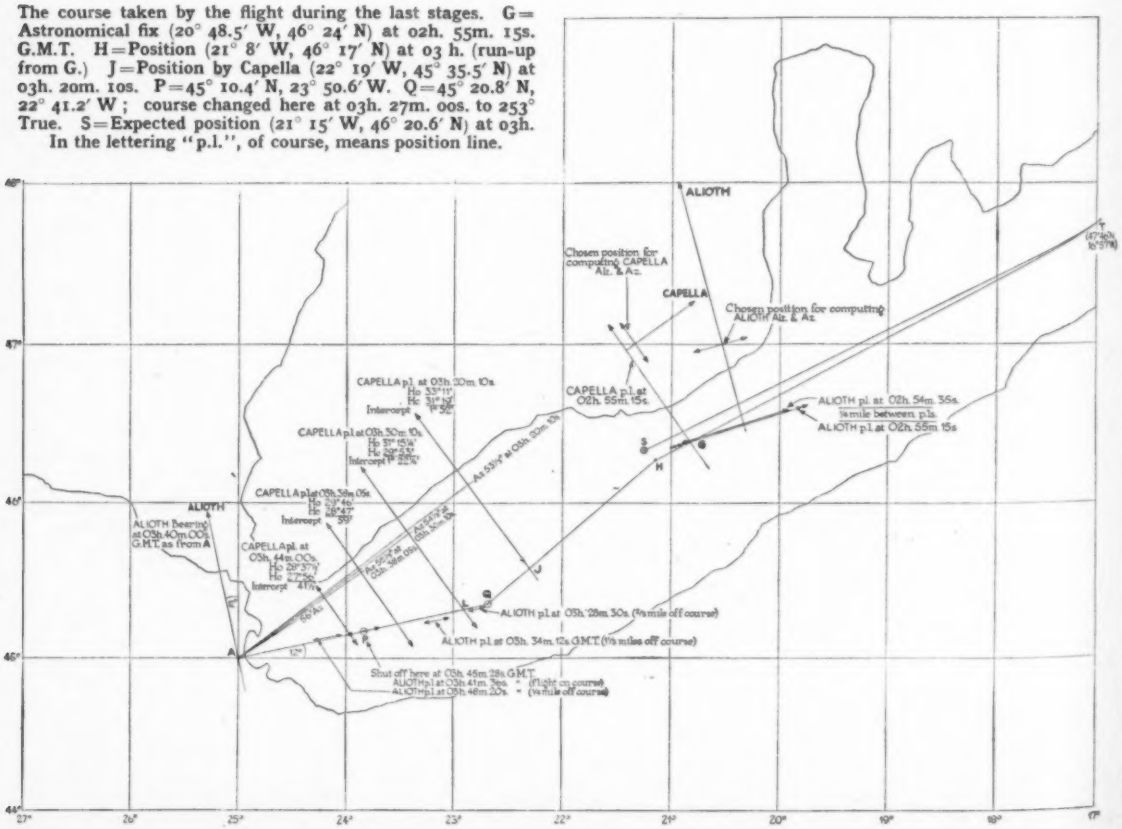


A diagram showing the effect of a star's change in azimuth. 15 minutes before the datum time the star's altitude observed at Q will not be the same as at P. At Q_1 it will be the same as at P.

So much for course-setting observations; the navigators will also need to know their exact distance from the objective. To do so, a star has been chosen for observation, which, among the suitable stars, is the nearest to being in line with the datum line either ahead or astern. An altitude and azimuth graph is prepared for this star, Capella. A, the objective, is used as the datum point for the calculations instead of P. A segment of compass rose is marked on the chart so that any bearing of the star as seen from A during the last half-hour can be plotted without having to lay it off with a protractor. The navigator pin-pricked the relevant azimuths, 53°—57°, on the chart and they do not show up.

When an observation of the star is made, the appropriate

The course taken by the flight during the last stages. G= Astronomical fix (20° 48.5′ W, 46° 24′ N) at 02h. 55m. 15s. G.M.T. H=Position (21° 8′ W, 46° 17′ N) at 03 h. (run-up from G.) J=Position by Capella (22° 19′ W, 45° 35.5′ N) at 03h. 20m. 10s. P=45° 10.4′ N, 23° 50.6′ W. Q=45° 20.8′ N, 22° 41.2′ W; course changed here at 03h. 27m. 00s. to 253° True. S=Expected position (21° 15′ W, 46° 20.6′ N) at 03h. In the lettering "p.l.", of course, means position line.



azimuth is drawn in and the observed altitude is compared with the graph altitude for that moment; the difference between them is laid off from A along the bearing and the position-line is drawn. The distance from A along the datum line to where the Capella position-line cuts it is the distance still to fly.

This information is obtained without much delay after the observation. As, however, the star's bearing differs from the route bearing by nearly 25°, the accuracy does depend on the accuracy of the other observation. For instance, if the aircraft were 5 miles off course and no allowance was made for it, the distance to fly would be in error by $5 \times \tan 25°$ miles, that is $2\frac{1}{3}$ miles. If the star were dead in line with the datum-line, this observation would be just as independent of the Alioth observation as the Alioth observation is of it. In any case, the datum-line method is planned to keep the planes accurately to their course, so that the fore and aft observation will give the distance to fly without reference to the beam observation.

In conclusion, it must be said that for precise astronomical navigation the importance of a good automatic pilot cannot be overstressed. If a single bubble sextant observation, made in an aeroplane manually piloted, is within 40′ of accuracy, it will be within 15′ of accuracy when the automatic pilot is switched in. With a particularly stable machine and extra sensitive automatic pilot this 15′ of possible inaccuracy would be halved and might be reduced to 5′, in which case it would not be necessary to take 48 sights of a star to get a position accuracy of 1′. Undoubtedly, development of accurate astronomical navigation is only just beginning.

* * *

The flight had left T. and expected to reach S. at 03 00 G.M.T. At the same speed it would reach the objective, A., 177.2 miles farther on, in $\frac{177}{196}$ of 60 minutes after 03 00 G.M.T., that is, at 03h. 54m. 15s. G.M.T. Drake had Alioth's altitude at A. computed for 03 40 G.M.T., that is to say, 15 minutes before the expected time of arrival there.

Altitude of Alioth precomputed for 03 40 G.M.T. at objective A. by No. 1 assistant using cosine formula:—

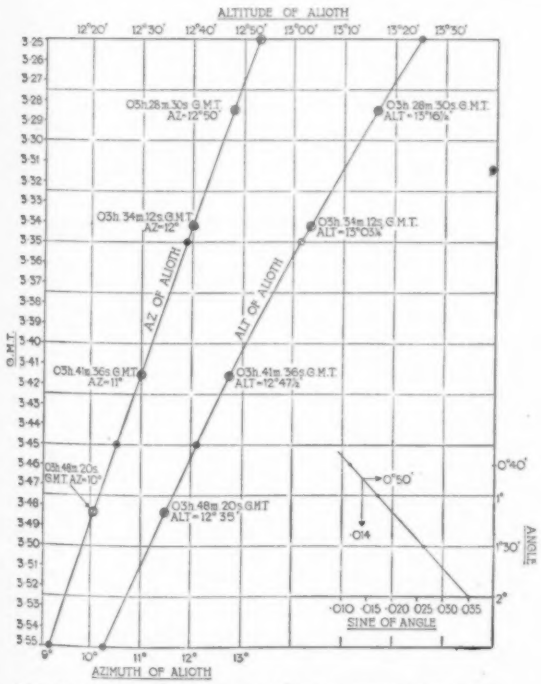
alt. = 12° 50½′

Check by No. 2 assistant, using Bygrave:—

AZ = N 11° 51½′ W.
alt. = 12° 50′

The resultant Alioth position line through A. was plotted. Two points were marked on it, P. 50 miles from A., and Q. 100 miles from A.

Q. was now an earlier objective. The navigators wished to be at Q. on the datum position-line through Q. and A. half an hour before the end of the flight. They would then run down this position-line to their objective, keeping to the position-line by frequent observations of Alioth which would be on the beam of the route throughout.



The Altitude and Azimuth of Alioth computed for point P. With it is a small graph designed for the quick reading of the sines of small angles between ½° and 2°.

Having fixed these points P. and Q., the altitudes and azimuths of Alioth at the point P. were precomputed for 03 25, 03 35, 03 45 and 03 35 G.M.T., and a graph was prepared of altitude against time so that the altitude of Alioth at P. could be read off for any moment, and also the azimuth.

Now, the bearing of the line APQ was at right-angles to an aizmuth of 12°, which, from the azimuth curve, was seen to be Alioth's azimuth at P at approximately 03.34 G.M.T. At this moment, therefore, the altitude of Alioth would be the same if observed from anywhere on APQ, subject only to a small correction for curvature of the position-line. This could be neglected unless more than 40 miles away from P, the correction being only −0 5′ at Q, 50 miles away.

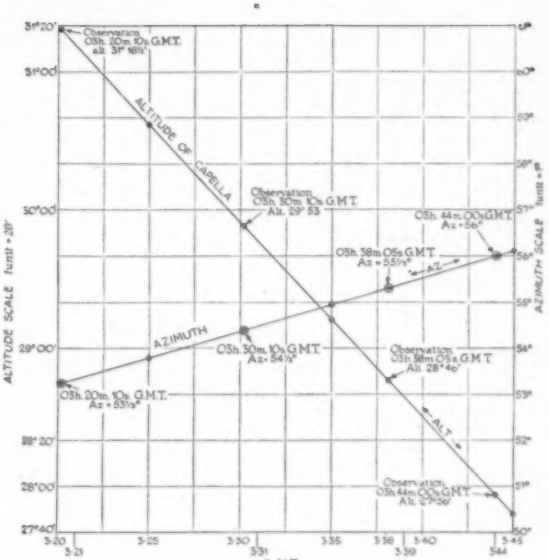
At this time, therefore, disregarding the negligible curvature correction, any position-line obtained, supposing the aircraft were off-course, would be parallel with the datum position-line APQ, and therefore the difference between the observed altitude and the graph altitude would be the distance off-course. For example, if the observed altitude was 50° 01′ and the graph altitude was 50° 00′, the planes would be off-course 1′ or 1 mile to star-ward.

Similarly, the amount off-course to the side of the datum position-line could be found at any time within a quarter of an hour of the datum-time 03 34 G.M.T., provided a small correction, due to change in azimuth of the star, was first applied to the graph altitude before comparing it with the observed altitude. The navigators would be able to observe Alioth up to the last moment before entering the clouds on the descent, and would be able to tell immediately after the observation whether they were on course, without the delay of first having to observe the other star or of having to do any instant between 03 25 and 03 55 G.M.T. the altitude and possible for the line of flight not to pass over the objective at the end of APQ.

The navigators therefore aimed to get to the point Q so that for the last half-hour of the flight they would have Alioth on the beam in this manner.

Another graph was prepared for Capella. This showed for any instant between 03 25 and 03 55 G.M.T. the altitude and azimuth of Capella at A. At the time of any observation of Capella its computed altitude at A could be at once read off and the difference between computed and observed altitudes would give exactly the number of miles from A to the position-line at right-angles to the star's bearing. Where this position-line cut the course would give the plane's position at that moment. By this means the work at the end of the flight would be reduced to little more than observing the two stars and plotting a position-line for Capella.

To construct these graphs did not entail the amount of work one might suppose.


ALTITUDE SCALE 1unit = 20′
AZIMUTH SCALE 1unit = 1°
ALTITUDE OF CAPELLA
AZIMUTH
ALT
AZ
Observation 03h. 30m. 10s. G.M.T. Alt. 31° 18½′
Observation 03h. 30m. 10s. G.M.T. Alt. 29° 53′
03h. 44m. 00s. G.M.T. Az = 56°
03h. 38m. 05s. G.M.T. Az = 55½°
03h. 30m. 10s. G.M.T. Az = 54½°
03h. 20m. 10s. G.M.T. Az = 53½°
Observation 03h. 38m. 05s. G.M.T. Alt. 28° 46′
Observation 03h. 44m. 00s. G.M.T. Alt. 27° 56′
G.M.T. 1unit = 2½ minutes

The Altitude and Azimuth of Capella as computed for position A—the flight's objective.

In the formula:—

Sin altitude = Sin latitude sin declination
+ cos latitude cos declination
cos Hour Angle,

the sine and cosine of the latitude and the sine and cosine of the declination were the same in all computations for a star. Sin latitude sin declination was, therefore, a constant, and it was only necessary to take out the hour angle for each computation, add the log of it to the logs of the cos latitude and cos declination already known, take out the anti-log of the result and subtract (because the hour angle exceeded 90°) the constant, sin latitude sin declination, from it to obtain the sine of the altitude.

Alioth:—

Position of P:—45° 10.4′ N.	23° 50.6′ W.			
Log Sin Lat, 45° 10.4′ N ...	T.85079			
Log Sin Dec, 56° 17½′ N ...	T.92006			
	T.77085			
which is anti-log of Sin Lat Sin Dec	0.589997			
Hour angle at	03 25 GMT	03 35 GMT	03 45 GMT	03 55 GMT
Sidereal Time 03 20 GMT ...	11° 39½′			
Sidereal Time of 5 mins. ...	1° 15½′			
S.H.A. or A.V. Alioth ...	167° 09½′			
G.H.A. Star	180 04			
Long. W.	−23 50.6			
Local Hour Angle at 03.25 ...	156 13.4	156 13.4	156 13.4	156 13.4
Add Sidereal Time for 0, 10, 20 and 30 mins.	0	2 30.5	5 01	7 31.5
to obtain Local Hour Angle...	156 13.4	158 44	161 14.4	163 44.9
Complement of Local Hour Angle	23 46.6	21 16	18 45.6	16 15
Log Cos Lat.	T.84814			
Log Cos Dec.	T.74427			
Sum of above	T.59241	T.59241	T.59241	T.59241
Log Cos H.A....	T.96149	T.96937	T.97630	T.98229
Sum	T.55390	T.56178	T.56871	T.57470
which is the antilog of Cos Lat Cos Dec Cos H.A. ...	0.358014	0.364570	0.370425	0.375578
To be subtracted from ...	0.589997	0.589997	0.589997	0.589997
	0.231983	0.225427	0.219572	0.214419
which is sine of the altitude...	13° 25′	13° 1½′	12° 41′	12° 23′
Azimuth by Bygrave ...N.	13° 18′W.	11° 55′	10° 32′	9° 08½′

Altitudes of Capella were taken out in the same way for 03 25 00, 03 35 00, 03 45 00, and 03 55 00 for position A, 45° 00 N., 25° 00 W.

Log sin lat	T.84949			
Log sin dec ...	T.85648			
	T.70597			
Antilog of Sin Lat Sin Dec	0.508123			
Local Hour Angles	03 25 00	03 35 00	03 45 00	03 55 00
03 20 Sid.	11° 39½			
	1 15½			
S.H.A.	281 57			
	294 51½			
Long. W.	25 00			
Local H.A. W/ ...	269 51½			
E/ H.A.	90 08½	90 08½	90 08½	90 08½
Subtract sidereal time for 10, 20 and 30 mins. respectively		2 30½	5 01	7 31½
Local Easterly H.A.	(89 51½)	87° 38	85° 07½	82° 37½
Log Cos Lat	T.84949			
Log Cos Dec (45° 56½) ...	T.84226			
Sum	T.69175	T.69175	T.69175	T.69175
Log Cos H.A....	3.39229	2.61589	2.92883	T.10868
Antilogs	3.08404	2.30764	2.62058	2.80043
	+0.0012135	−0.0203067	−0.0417427	−0.0631583
Combined with Sin Lat Sin Dec	+0.508123	+0.508123	+0.508123	+0.508123
	0.5093365	0.487816	0.466380	0.444965
Alt.	30° 37′	29° 12′	27° 48′	26° 25′
Check by Bygrave y =		87° 42⅔	85° 17⅔	82° 54⅓
colat =		45	45	45
A =		132° 42⅔	130° 17⅔	127° 54⅓
		54° 57′	56° 06′	57° 07′

For 03 25 G.M.T. the hour angle was too close to 90° for Bygrave to be used to obtain the azimuth. (In normal practice one would change the longitude of the D.R. position by 20 minutes of arc.) The three azimuths obtained sufficed to draw an azimuth graph. All computations for the navigation of the last half-hour of the flight were thus completed while the 'planes were on their way from T to S.

Drake now proceeded to fix the position at 03 hours near S. No. 3 assistant used Dreisonstok's tables for the computations. (As these tables are similar to the Hughes-Comrie tables, the work is not described.) The 03 hours position was determined at H.

The flight had been expected to be at S at 03 hours. As it was at H, there had been a component equal to SH acting in addition to the wind 46 knots from 226½° allowed for. The result of these two components was found on the Dalton "G" by plotting first a wind AS, 46 knots from 226½°, then HS, 6 knots from 306° (equal to SH). The resultant AH was read off and found to be 47½ knots from 233⅓°. This was the wind during the past hour.

Drake hurriedly computed the course to fly to get to Q from H and the time it would take:

$$\text{D Lat H and Q} = 46^\circ 17' - 45^\circ 20.8' = 56.2'$$

$$\text{D Long} = 22^\circ 41.2 - 21^\circ 08' = 1^\circ 33.2' = 93.2 \text{ mer. parts.}$$

$$= 65\tfrac{1}{2} \text{ miles.}$$

$$\therefore \tan \text{track} = \frac{65.5}{56.2}$$

$$\text{Track} = 180 + 49^\circ 22' = 229^\circ 22'$$

$$\text{Distance HQ} = 56.2 \text{ sec. } 49.22' = 86.3 \text{ miles.}$$

On the Dalton "G" he set the wind 47½ knots from 233⅓°. Then he set the required track 229⅓°, and under the beginning of the wind arrow the airspeed 240 knots. He read off that he must fly a course ½° to the right of the track—namely, 230°—and the ground speed would be 192½ knots.

The time taken to fly HQ, 86.3 miles, would be

$$\frac{60 \times 86.3}{192.64} \text{ minutes}$$

$$= 26.9 \text{ minutes.}$$

At 03.00 G.M.T. he therefore had the course changed to 230° True:

230° True + 20° 30′ W/y Variation + 3° W/y Deviation
= 253½° compass course.

At 03.20 he had Capella observed.

The average time of the 8 series was 03.20.10 G.M.T., and the corrected average of the shots 33° 10½′.

A glance at the graph for Capella's altitude and azimuth showed that the computed altitude at A at that moment was 31° 18½′, and the azimuth 53½°. He plotted the azimuth and drew a position line through a point on it 1° 52′, or 112 miles from A, this distance being the difference between the observed and computed altitudes. The position-line cut the track at J. HJ, 64½ miles, was the distance flown from H in 20⅛ minutes. The ground speed was, therefore,

$$64\tfrac{1}{2} \text{ miles in } 20\tfrac{1}{8} \text{ minutes} = \frac{60}{20.17} \times 64.5 \text{ knots.}$$

$$= 191.9 \text{ knots.}$$

It had been expected to be 192.6 knots.

The actual ground speed was close enough to this to show that the wind speed had been gauged nicely.

At 03.27 Drake changed course to 253° to make good a track of 258° True, with the same wind of 47½ knots from 233⅓°. To ascertain this course he had set the wind on the Dalton "G" and found the drift would be 5° to the right. The ground speed would be 195½ knots on the new course.

The compass course was 258° track − 5° for drift + 21° W/y variation + 3° W/y deviation = 277°.

He immediately ordered observations to be made of Alioth. The times averaged 03.28.30 G.M.T., and the altitude observations 13° 14⅜′. From the Alioth graph the altitude for 03.28.30 G.M.T. was read off and found to be 13° 16⅛′.

The graph altitude was corrected because the observation was made near Q, 50 miles away from the datum point P. The altitude at Q would be ⅛′ less than P, owing to curvature of the position line. It would also be less because the star was not yet abeam. Its azimuth, 12° 50′ West, was 50′ less than the abeam azimuth of 12°. The altitude at Q was less than that at P for this reason, the amount being 50 sin 0° 50′. Sine 50′ was read off the graph as .014. The correction was − 0.7 miles.

The corrected graph altitude was, therefore, 13° 16½′ − 0.5′ (for curvature) − 0.7′ (for azimuth change) = 13° 15⅓′. The flight was, therefore, off course two-thirds of a mile on the side away from the star. Drake did not consider this worth correcting.

Capella was then observed, and the average time for the eight series of observations was 03.30.10 G.M.T. Inspection of the graph showed that the altitude at this time should have been 29° 53′, and the azimuth 54½°. The azimuth was plotted and a distance marked off along it equal to the difference between the graph altitude and the observed altitude. The observed altitude was 31° 15¼′, and the intercept, therefore, 82½ miles.

A position line was drawn and found to cut the track at L, 10 miles along it from Q. QL was, therefore, the distance flown in 3 mins. 10 secs. At the calculated ground speed of 195½ knots the flight should have flown $10\frac{3}{10}$ miles in 3 mins.

10 secs. The flight was within $\frac{3}{16}$ mile of its anticipated position at that moment. Observation was again made of Alioth. The times averaged 03.34.12 G.M.T.

From the Alioth graph the course altitude was read off as 13° 03½′. The star was dead abeam of the datum line for this observation, and no correction due to change in azimuth need be applied. As the observation was made when about 30 miles from P, no correction was required for curvature of the position line; in fact, this correction only needed considering when at a distance of 40 miles or more from P. The observed altitude was 13° 02′, which put the flight 1½ miles off course to the left in 7.2 minutes. Drake ordered a change of course of 6⅔° to the right for 7 minutes, being 3⅓° allowance for drift and 3⅓° to make good the leeway.

Two assistants with Aldis lamps signalled the magnetic course 284° to the accompanying bombers.

The next observation of Capella came out at 03.38.05 G.M.T. The graph reading of altitude for this time was 28° 46′, and of azimuth 55½°.

The azimuth was plotted, and the intercept 59 miles (29° 46′) marked off along it. The position line at right angles to the azimuth bearing was plotted, and it was found that the flight had done 36 miles in the 11 mins. 5 secs. since point Q. This was a ground speed of 195 knots. It meant that they were 100 – 36 = 64 miles from the objective, and only 60 – 36 = 24 miles from the point where Drake proposed to begin the descent. It would take 7 mins. 23 secs. to fly the 24 miles at the present ground speed. Drake warned the pilot to shut off at 03h. 45m. 28s. unless he countermanded the order.

Another Alioth sight came out at 03h. 41m. 36s. The graph reading was 12° 47½′, and the observation 12° 48′. The flight was, therefore, on its course. (*Note.*—The azimuth was 1° different from the datum azimuth, but no correction was required because the position was near P.)

They had made good the leeway found 7 mins. earlier, and Drake ordered a change of course to the left of 3½°, signalling the magnetic course to the two bombers, 280½°.

Capella was observed quickly. The times came out at 03h. 44m. 00s. From the graph the altitude was read off at 27° 56′, and the azimuth at 56°. The azimuth was plotted as before, and a point marked on it the same distance from A as the difference between the computed and the observed altitudes, 41½ miles. The position line was plotted through this point and found to cut the track at a point 55½ miles from Q. This showed a steady ground speed of 195 knots. The decision to begin the descent at 03h. 45m. 28s. still stood, therefore.

They had reached the point for descent while these computations were in progress. The pilot had throttled down at 03.45.28 G.M.T. At the same moment two assistants had flashed the red signal agreed upon to the two bombers. The special flaps had been put down. These had been set to allow a drop of 2,300ft. per minute with a gliding speed of 240 knots True. A fast descent had been planned so that the aircraft should not be subject to different and unknown winds on the way down for longer than necessary.

As the bombers descended they changed their indicated air speed in the same way that they had done on the initial climb. (They had made minor adjustments of indicated air speed every hour of the flight for varying temperature en route.) The temperature before starting the descent was – 18° C., and the indicated altitude for a correct altitude of 25,000 was 25,700ft.

Height, feet	Temp. at	Indicated air speed
25,700 to 20,000	22,500 – 15° C.	167 knots.
20,000 to 15,000	17,500 – 10° C.	182 knots.
15,000 to 10,000	12,500 – 5° C.	198 knots.
10,000 to 5,000	7,500 6° C.	215 knots.
5,000 to 1,000	3,000 + 4° C.	231 knots.

Drake had anticipated that the wind would be 22½ knots less at ground level—namely, 25 knots. Allowing for an average wind on the way down of 37½ knots, the average ground speed would be 206, and the drift ½° less to the right. The change in drift would put the machines ½ mile more to the left, which was to the good because they were ½ mile to the right at the start of the descent. At an average ground speed of 206 knots they would fly the 40 miles in 11.7 mins. Coming down at 2,300ft. a minute, they would be at 1,000ft. in 10⅔ minutes.

The cloud level was now some 10,000ft. below 25,000. A final observation of Alioth was rusher through. The times averaged 3.48.20 G.M.T. The graph altitude was 12° 35′. As the position was about 20 miles past P, and the azimuth change from the datum azimuth of 12° was 2°, a correction of 20 sine 2° was applied—namely, .7′. The corrected graph altitude was, therefore, 12° 35′ – 0.7′ = 12° 34.3′. The observed altitude, 12° 34½′. The flight was within half a mile of its course on the star or north side.

On the Target

Drake gave the word, and O.K. was signalled to each bomber. They now knew they were within a mile of a course heading direct for their objective, and that if they kept on losing height at 2,300ft. a minute and at a true air speed of not more than 240 knots, they should come out 2 or 3 miles from the objective and be headed within a mile of it.

At 3.50½ the 'planes entered the cloud at 14,800ft. Drake immediately slowed up 10 knots. The machine on the right held its course; that on the left changed course 3° to the left, as arranged.

Drake's machine broke through the cloud ceiling at 1,250ft. It was over water. Ships were at anchor ahead, lighted up. A few searchlights idly travelled the cloud. No alarm had been given. What had happened to the bombers? A searchlight suddenly brought its beam to the vertical. There was a flash which lighted the town. Drake's pilot opened up his throttle, but no one heard the spluttering motors. After an interval which seemed to the watchers interminable, there was a double smoky flash. Drake shouted to his pilot to turn. They saw the tiny flash of a distant gun. The searchlights were collecting over the town. Drake and his crew seemed to be watching for a long time as the aircraft turned. The whole sky was lit up by an explosion. In the lurid glow left by the first explosion a second took place almost immediately. Dark puffs of smoke spotted the glow. The navigating machine climbed back into clouds, leaving an infernal scene of gun flashes and shell bursts filling space between the clouds and the town.

LAST WEEK'S AIR SERVICES

AFTER a temporary cessation, the two companies operating to and from neutral countries recently resumed certain European services. These were K.L.M. and S.A.B.E.N.A. Last week the latter sent their first machine to England from Brussels, carrying mail only, but they were due to start the operation of two daily passenger services.

K.L.M. were still running daily between this country, Holland and Scandinavia, flying via Amsterdam, Copenhagen and Stockholm, where connections were made to Riga and Moscow. D C.3s were used and the word "Holland" is painted on the under sides and top of the fuselage. K.L.M. are also still running their Far Eastern service to India, the Dutch East Indies and Australia. The route used for the Far Eastern service is via France and Italy to Alexandria, and it is possible that K.L M. will eventually open a service to Lisbon to make a connection with the Pan American Airways service.

It is possible, in the near future, that Swissair may also reopen the Zurich service, provided that permission is received from the French Government for the machines to fly over French territory. Presumably the service will be run via the western side of France

Last Sunday, however, the Air Ministry asked that all services, neutral or otherwise, from this country should be suspended until further notice

Pan-American Airways are still running their Atlantic services, but the Boeing 314s do not proceed in an easterly direction beyond Foynes. Imperial Airways are runing two services to Australia and one to South Africa, carrying passengers as well as surcharged mails.

As far as internal services are concerned, the Air Ministry has granted special permission to Allied Airways to operate their services, which are considered to be "safe." Actually, A.A. cancelled all services on only one day (September 2) and from now on will operate from Aberdeen to Wick, Thurso, Stromness and Kirkwall. The Orkney-Shetland route, however, is no longer served, though ambulance runs may be made.

Captain Stack Progressing

HIS many friends will be glad to learn that Capt. T. Neville Stack is making good progress after his recent accident, as is also his passenger. It may be recollected that they crashed when attempting to land on the Austin aerodrome, but the circumstances were a little different from those reported at the time. The machine was making the usual "rumble" approach, and when Stack opened the throttle, some 400 yards from the aerodrome boundary, the engine failed to respond. As the glide could not be stretched sufficiently there was no alternative but to pancake the machine on to the embankment, some 50 yards short of the runway.

Topics of the Day

Nothing to do with the subjects discussed by "Indicator," but Connor Park aerodrome, Australia, with a portion of the town of Rockhampton in the background. It is the mid-way stopping place between Brisbane and rich north-west. Airlines of Australia run a daily service each way with Stinson Trimotors. One of the two Dragons belongs to Aircraft Pty. and is used for carrying Sunday newspapers from Brisbane. The D.H.86 belongs to W. R. Carpenter and was, when the picture was taken, on its way from New Guinea to Sydney. The Monospar belongs to Air Taxis, while the Moth is owned by the Rockhampton branch of the Royal Queensland Aero Club.

MAKING USE OF US

. . . *The Experienced Amateur Comes into His Own : Transport Reorganisation*

TO what exact uses civil machines, large and small, may eventually be put, I do not know—and if I did I should not, at the moment, be able to say. But one thing is certain, that in this full-scale emergency it is to the experienced amateur that the transport organisations and the fighting services are turning for incidental flying assistance.

Already there are three schemes for which our (that is, the experienced amateurs') services are being acquired, and before long there will possibly be others. One is known as the Air Transport Auxiliary, another is a plan for doing various flying jobs of work in connection with the Fleet Air Arm, while a third is for R.A.F. work of an instructional or non-operational nature.

That remains to be seen. Such work would demand, as a preliminary, at least a month's intensive training on the various current twin-engined types. Given good weather, and a set of intelligent and experienced amateurs, such a conversion course on, say, half a dozen modern types, could probably be completed in a month or six weeks.

This is no moment to remark, "I told you so," but for the last two years everybody in civil aviation has realised that there was a large stock of sound pilots, though too old for direct service in the Air Force, whose experience was there to be used. Nothing was done about it, though one operating company pressed for their enlistment at least six months ago, and this paper was hammering away long before the C.A.G. scheme came into operation.

At the moment, it appears, the R.A.F. have almost more pilots than they know what to do with, and it was obvious that the amateurs between the ages, say, of 30 and 50 could not all be given useful work in the Service itself. At the same time, it would have been a gross waste of experience if these pilots had been forced, through lack of other duties, to join other fighting services or to take up ground work of national importance. Very few Reserve pilots have put in the flying which will be found in the logbooks of scores of amateurs.

Admittedly, this flying has been done on light or medium-light aeroplanes, and flying forms only a part of the military pilot's syllabus. But there are all manner of useful duties which can be carried out by otherwise untrained pilots—thus leaving the real people to do more urgent work for which their training fits them. Military training, for instance, is not an essential for communication duties or even for Army co-operation work.

Until the demand arose, however, I do not think that even those who were keen that the amateurs' experience should be used realised quite what a tremendous store of experience was, in fact, available. I knew that there were scores of private owners and other with upwards of 300 hours in their log books, but not until I accidentally caught a glimpse of a list of applicants for certain work did I discover how many had put in more than 1,000 hours.

Little by little the opportunities will appear, and it is up to the Air Ministry, directly or indirectly, to make the most of the service of men who would really be wasted in any other work.

At least for the present it is not possible to say either what is being done by the British transport companies or, even, where the numerous equipment items in the civil air fleet are actually stationed. But it can now be said that a week ago two or three well-aimed bombs could have pretty well destroyed the whole lot. By now the units have been spread, the civil aerodromes concerned camouflaged, and the beautiful shining machines painted a sickly green colour. In fact, on one day the crews of a dozen machines were set to work with paint brushes—such was the urgency of the situation. For their work in clearing out and reorganising to suit the new conditions the transport companies and their personnel must be given full marks. Within three days the entire jumble of men and material was being straightened out, and one of the companies had even got its pilots' school going again.

INDICATOR.

MACHINES of the LUFTWAFFE

Some Notes on German Air Force Equipment

EXCEPTING possibly Russia, Germany has been more reticent on the subject of her air force than any of the great Powers. Despite this, *Flight* has managed to collect and correlate a good deal of information on current types of German military aircraft. A certain amount of this is published in this issue in company with a unique set of recognition drawings which show the characteristic features of most of the Service types in use.

Germany appears to favour the high-speed, twin-engined lightly armed bomber, as typified by the Heinkels (He 111 and its derivative type), the Dornier Do 17, and the 215 which has been developed from it, and the new Junkers Ju 88. This formula is also being followed by certain other countries, which, like Germany, now regard with disfavour slower machines with heavier turret-mounted armament. Despite her partiality for aircraft of this sort, Germany is known to have a number of Junkers Ju 89s with four Junkers inverted, vee-twelve, liquid-cooled engines. The Ju 89 may be considered as the Service version of the Ju 90 commercial machine. It is possible that this type is regarded as a bomber transport; the familiar Ju 52 is now a standard machine in this category, and is known to be used for the transport of parachute troops.

It would appear likely that the Ju 89 has gun turrets, possibly with power drive, though simple manually operated mountings are used on the other types of bomber.

A new type in a new category is the Messerschmitt Bf 110 fighter-bomber, which is believed to be armed with shell-firing guns and large-bore machine guns. This type is already in service in considerable numbers. Single-seater fighters include the Heinkel He 112 and Messerschmitt Bf 109, together with modified versions of these designs, which, despite statements made by their manufacturers, are *not* identical with the machines used to break the world's speed record.

For specialised dive-bombing work the standard type is the Junkers Ju 87, which has special flaps to limit its diving speed. The single-seater fighter-bombers made by the Henschel and Blohm and Voss concerns are now obsolescent.

A symbolic view of a fly-past of Heinkel bombers (modified He 111 K type) during the parade before Herr Hitler at Charlottenburg on April 20 this year.

For strategical reconnaissance the *Luftwaffe* employs adaptations of high-speed, twin-engined bombers, while the Henschel Hs 123 (counterpart of our Westland Lysander) is used for artillery spotting and general observation work.

Training machines include large numbers of obsolescent Service types, specialised single-seater fighter trainers (several of which are noted for their aerobatic qualities) and large numbers of small twin-engined crew trainers, apart from the normal *ab initio* two-seaters.

For coastal and over-sea work there are Heinkel monoplanes on floats, three-engined Dorniers (these, unlike the machines of their type supplied to Holland, are said to have liquid-cooled engines, though our drawing shows an air-cooled installation), and military versions of the twin-engined Dornier Do 18 with Junkers diesels. It is believed that the single- and twin-engined Heinkel biplanes on floats are now used for training.

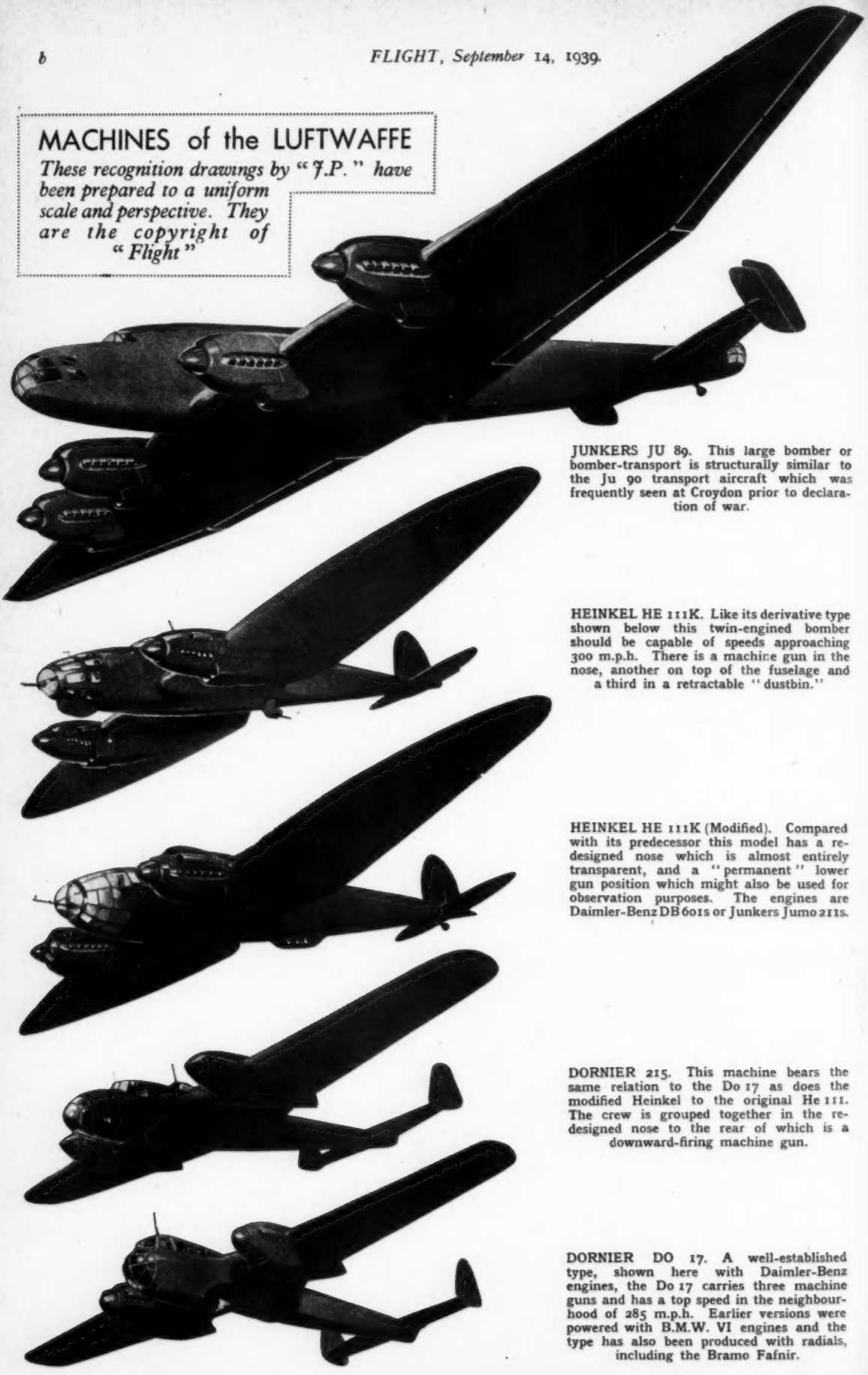
A type corresponding to our torpedo-spotter reconnaissance aircraft is the Arado Ar 95 biplane, which is regarded as a maid-of-all-work. This machine is powered with a B.M.W. radial.

It is not known which types will be selected to equip the new aircraft carrier *Graf Zeppelin*, but warships in service at present are allocated Heinkel floatplanes, one type being a sesquiplane. Photographs have appeared of monoplanes installed carried on ships' catapults. The type concerned would appear to be of Arado design, and, in fact, resembles, except for the wing cellule, the Ar 95. The catapults are of Heinkel design.

A Messerschmitt Bf 109 single-seater fighter. This machine is said to have fine flying qualities and is fitted with Handley Page slots and flaps.

MACHINES of the LUFTWAFFE

These recognition drawings by "J.P." have been prepared to a uniform scale and perspective. They are the copyright of "Flight"



JUNKERS JU 89. This large bomber or bomber-transport is structurally similar to the Ju 90 transport aircraft which was frequently seen at Croydon prior to declaration of war.

HEINKEL HE 111K. Like its derivative type shown below this twin-engined bomber should be capable of speeds approaching 300 m.p.h. There is a machine gun in the nose, another on top of the fuselage and a third in a retractable "dustbin."

HEINKEL HE 111K (Modified). Compared with its predecessor this model has a redesigned nose which is almost entirely transparent, and a "permanent" lower gun position which might also be used for observation purposes. The engines are Daimler-Benz DB 601s or Junkers Jumo 211s.

DORNIER 215. This machine bears the same relation to the Do 17 as does the modified Heinkel to the original He 111. The crew is grouped together in the redesigned nose to the rear of which is a downward-firing machine gun.

DORNIER DO 17. A well-established type, shown here with Daimler-Benz engines, the Do 17 carries three machine guns and has a top speed in the neighbourhood of 285 m.p.h. Earlier versions were powered with B.M.W. VI engines and the type has also been produced with radials, including the Bramo Fafnir.

JUNKERS JU 86K. Powered with Junkers Jumo diesels (as shown) or B.M.W. radials, this machine is now regarded as obsolescent. Its performance is inferior to that of the Heinkels and Dorniers though Junkers have lately been producing Ju 88 bombers which are said to be very fast indeed.

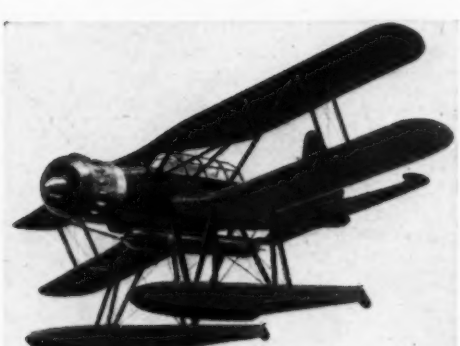
JUNKERS JU 87. Employed as a specialised dive-bomber carrying a single 500 kg. or 1,000 kg. bomb, the Ju 87 is fitted with small air brakes just aft of the leading edge. These limit the speed during a bombing dive and permit a closer approach to the target.

HEINKEL HE 115. A comparatively new twin-engined floatplane. This aircraft is normally fitted with B.M.W. radials and can be used for torpedo dropping, bombing and reconnaissance. It is *not* merely a seaplane version of the bombers illustrated on the opposite page.

DORNIER DO 18K. Two Junkers diesel engines give this machine an unusually long range, though the performance is quite low as indicated by the fact that the machine guns are installed on unprotected manually operated mountings.

DORNIER DO 23. Shown here with air-cooled radials, this large military flying boat is believed to be used with liquid-cooled engines. The guns are mounted in turrets and defensive armament is installed in the extreme tail.

HENSCHEL HS 126. Used for observation and short-range reconnaissance, this B.M.W.-powered machine is employed in large numbers by the German Air Force. Two or three machine guns and a light bomb load can be carried.



ARADO AR 95. Produced as a landplane or seaplane, this model can be used for torpedo dropping, bombing, reconnaissance, smoke-screen laying, etc. It also functions as a dive bomber and is, in fact, comparable with our T.S.R.s.

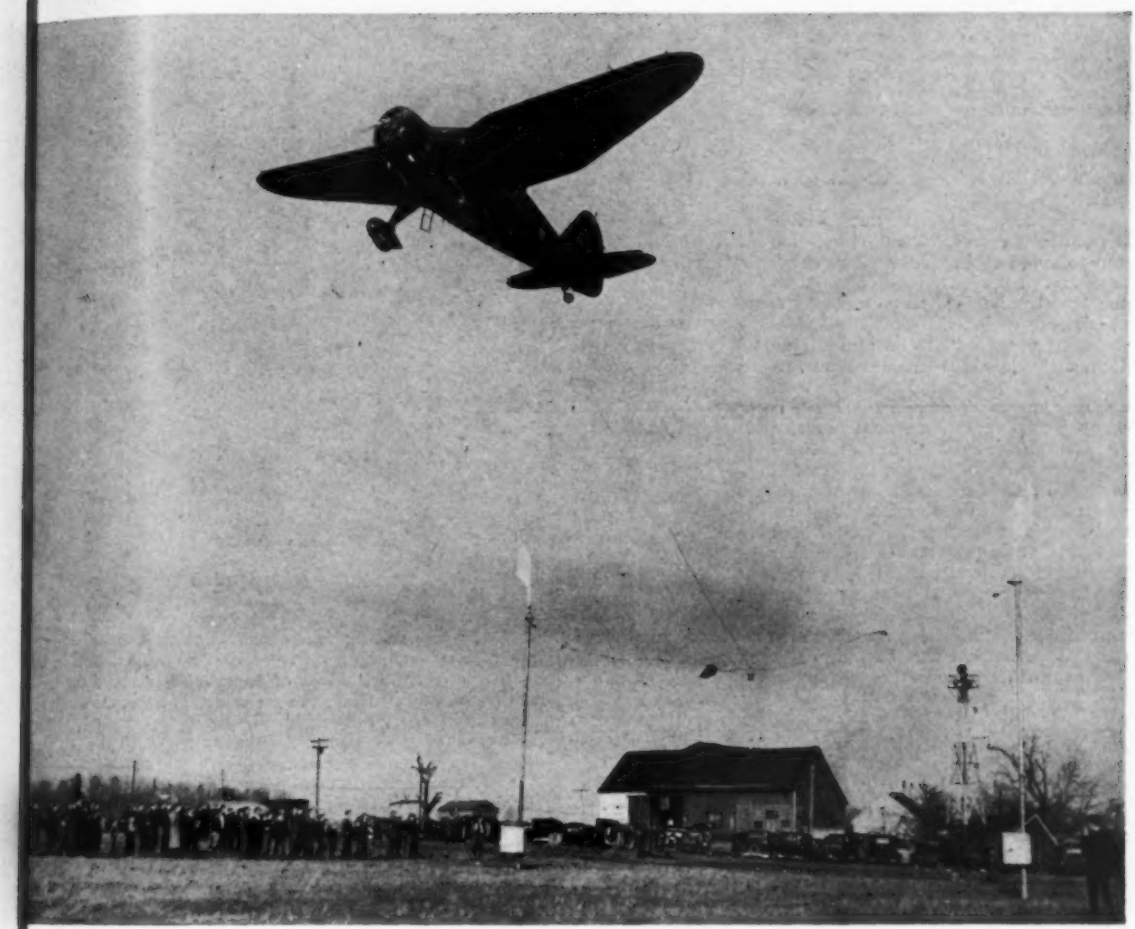
MESSERSCHMITT BF 110. A new twin-engined fighter-bomber fitted with Daimler-Benz or Junkers liquid-cooled engines this machine, for which great things are claimed, can be armed with two 23 mm. shell-guns and a number of large-bore machine guns. The top speed is said to be in the region of 350 m.p.h. though it may well be more.

MESSERSCHMITT BF 109. A single-seater fighter widely employed in the *Luftwaffe*, the Bf 109 is fitted with a Daimler-Benz or Junkers engine. The type commonly in use is believed to be inferior in performance and armament to the Supermarine Spitfire. Some of these machines are believed to be fitted with shell-guns of 23 mm. calibre.

HEINKEL HE 112U. Developed from the Heinkel He 112, which is now some years old, this fighter is probably the fastest in service with the *Luftwaffe*. It bears a certain relationship to a machine used by Germany to break the world's speed record.

BLOHM AND VOSS HA 137. It is not definitely known that this single-seater fighter-dive-bomber is in squadron use. The original machines, at least, were fitted with an early type of Junkers inverted vee-twelve engine and were quite slow.

HENSCHEL HS 123. A sturdy biplane capable of functioning as a single-seater fighter or dive-bomber this aircraft is normally fitted with a B.M.W. radial. Like the Blohm and Voss monoplane it carries two or four machine guns.



A standard Stinson Reliant of All-American Aviation, Inc., picking up a mail container at a small town which has no aerodrome.

PICKING-UP MAILS

The System Used on Two American Air-mail Routes

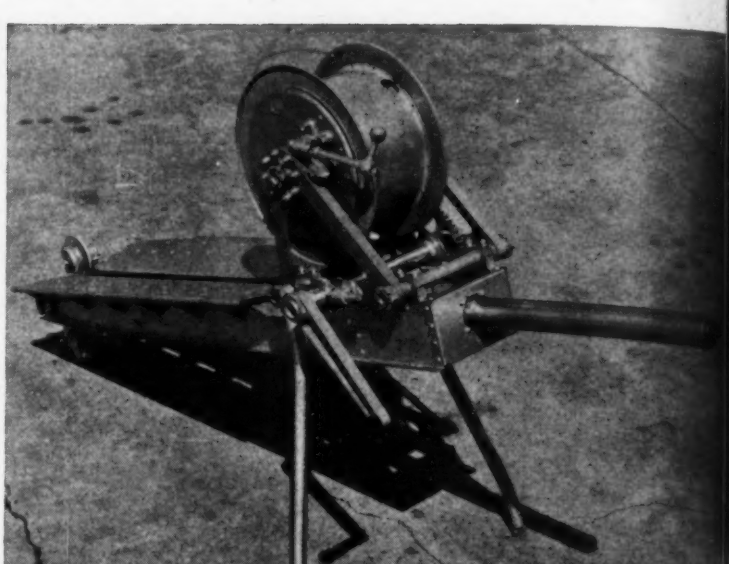
By HARRY WILKIN PERRY

DAILY operation of a unique pick-up system is maintained on two air-mail routes in the United States. These routes traverse parts of the contiguous states of Delaware, Pennsylvania, West Virginia and Ohio—a mountainous region that has justified the appellation "graveyard of aviation" because of the many crashes of air-mail planes on the mountain sides in foggy weather in the past. They are confidently regarded as the beginning of an ultimate nation-wide system of airline feeder routes that will serve a majority of all communities in the country. They are test routes established to prove the practicability, advantages and operating economy of providing aeroplane mail and express service to cities and villages off the through air lines and intermediate points between airport cities on the main routes.

The two routes are operated by All-American Aviation, Inc., of which Richard C. duPont, a scion of the duPont family which founded and controls the vast explosives and chemical firm of E. I. duPont de Nemours et Cie., is president. Standard Stinson Reliant single-engined, five-passenger planes used by the operating company fly 1,540 miles daily, serving 58 communities varying in size from 800 to more than 100,000 population, and make 75 pick-ups of mail and express. They feed into main airlines at Philadelphia and Pittsburgh—two great cities on the trans-continental airway. Pick-up and delivery are made at intervals varying from 5 to 22 miles, yet a schedule that calls for an average elapsed-time speed of 100 m.p.h. is maintained, even under adverse weather conditions and against headwinds as high as 30 m.p.h.

Such a performance would be quite impossible if the planes had to land and take off at each community, but it is made practical by the novel delivery and pick-up method and apparatus employed. These enable the planes to drop sacks of mail and express and pick up sacks of outgoing letters and express parcels while flying at 90 to 110 m.p.h. No landing field is required for the exchange; hence villages of small size along an irregular route connecting larger villages and cities can have the advantage of air-mail service.

One of the photographs shows an aeroplane in flight picking up a mail sack at one of the small villages. It reveals the simple ground equipment employed, which consists of two steel poles set in concrete 60ft. apart and extending 30ft. into the air, each topped by a 10ft. wooden flag or marker painted a bright orange colour; a transfer rope suspended horizontally between the tops of the poles; and a mail sack container hung from the rope midway between the poles. To effect delivery and pick-up, the plane approaches the station on a smooth glide at cruising speed

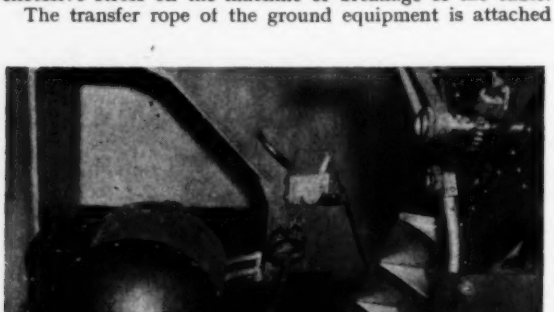


On the right, one of the winch units carried in the aeroplane. The unit also incorporates the oleo-pneumatic shock absorber which relieves the aeroplane of part of the pick-up shock.

and levels off at an altitude of 50 to 70ft.

Considerable special but simple apparatus is required for the operation and to avoid shock to the plane structure and damage to the contents of the mail and express sacks. A specially designed steel grapple, weighing upward of 10 lb. and having four curved, blunt-ended prongs, is attached at one end of a 60ft. steel cable. The other end of the cable is secured to a reel in the aeroplane for winding up the cable to draw the mail container into the ship. This crank-operated reel is mounted on an automatic air-oil shock-absorbing unit resembling a gun recoil absorber and having a stroke of 2ft. Operating air pressure of 45 lb. per sq. in. is carried, but the unit is designed for a pressure of 100 lb. It absorbs only a small percentage of the pick-up shock, but is necessary to obviate excessive stress on the machine or breakage of the cable.

The transfer rope of the ground equipment is attached to hoisting lines on the poles by snap hooks that engage ball-weighted spring clips from which the snap hooks pull free at a tension of 120 lb. When the trailing grapple catches the rope, the rope is pulled out of the spring clips and, with the mail-sack container, is carried along with the ship and is wound up on the reel through a hatch in the belly of the cabin. Most of the shock is taken up by a friction block by which the container is hung on the rope. This simple energy-absorbing device slides gradually along the rope during the pick-up, allowing the burden a distance of 30ft. in which to accelerate.



Mail container in the rear end of the cabin. One end of the delivery rope is attached to the release device. On the right can be seen part of the winch gear used for picking-up mails.

Other equipment is used for making deliveries in flight. Directly above the pick-up hatch in the aeroplane is a release device operated by the pilot. One end of a long rope is attached to this, and the other end to a sack container. As the machine approaches a station, the pilot's assistant lowers the container to the limit of the rope and also lowers the pick-up grapple on its cable. The grapple hangs suspended from the plane about 2ft. forward of the delivery release, and the two lines are prevented from fouling each other by their respective drag/weight ratios. When release is made, the container and rope fall clear of the grapple and its cable because of their greater air drag. The pick-up is then made after the delivery.

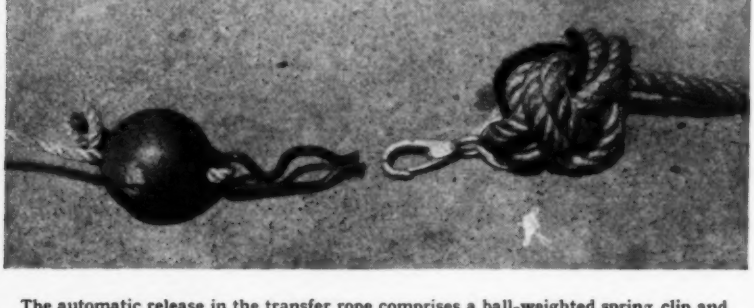
Special Containers

Sacks and their contents are protected from damage by containers designed to withstand the impact of being dropped from heights of 20 to 100ft. from a plane travelling 100 to 120 m.p.h. The container has a dome-shaped hard fibre top or nose to the upper centre of which is affixed a steel ring and the pulley-like friction suspension device. To the inside of the nose is riveted a deep cylindrical rubber skirt. Sacks having a capacity of 60 lb. are hung inside this assembly, which encloses fully one-half the sack. Air mail letters are placed in specially designed pouches which are put in with the express parcels.

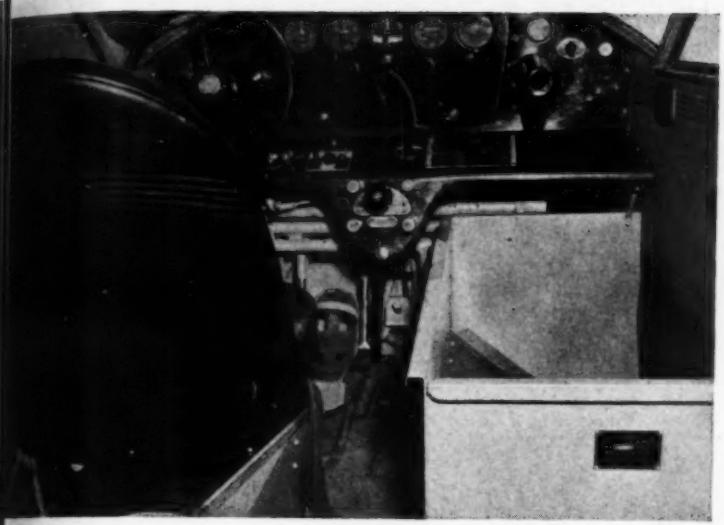
Although in present operations the pick-up load has been limited to 20 lb., loads up to 70 lb. have, according to the operating company, been picked up in tests with the equipment described without imposing any undue stress on the plane or giving any indication that the limit of load has been reached. Nor has there been any indication of limitation of the speed at which pick-ups can be made with gear designed to take greater shocks.

All but the pilot's seat were removed from the Stinson aeroplanes to make room for installation of the pick-up gear, mail bins, and a special seat in the rear for the pick-up operator.

A main bin beside the pilot's seat



The automatic release in the transfer rope comprises a ball-weighted spring clip and a snap hook. The hook pulls free at a tension of 120 lb.



The mail bin on the right-hand side of the cockpit has a capacity of 250 lb. The aeroplanes are provided with two-way radio.

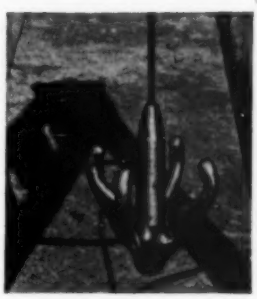
has a capacity of 250 lb. All the planes have two-way radio, and a communication system has been worked out with co-operation of the regular Civil Aviation Authority range and communication stations and the American Airlines. Positions of the pick-up planes are reported directly through control towers at the airway airports or by the C.A.A. teletype system.

All-American Aviation holds recently awarded Government air mail contracts for the two routes served, but is not yet licensed to carry passengers. That is the next logical step in the development of feeder airlines. It is not suggested that passengers be dropped and picked up at 100 m.p.h., which might conceivably deter them from patronising the service! The proposal is that they should embark at towns having suitable landing fields and make relatively short trips to the larger cities, where regular airports are used for stops on the major airlines.

No formal experiments have yet been made with passenger planes equipped with mail delivery and pick-up apparatus, but flights have been made over part of the pick-up routes with several passengers in twin-engine craft capable of carrying a crew of two and from five to seven passengers at a cruising speed of 150 to 180 m.p.h. Conditions simulating actual operations caused the passengers no mental or physical discomfort during the frequent glides to the transfer stations. Actually, the pick-up operation is safer than making a landing, as the aeroplane never approaches stalling speed and is always under complete control.

Only a little more than one-fourth the population of the United States is now served directly by established airlines. Exclusive of the 58 communities on the All-American Aviation pick-up routes, only 210 of the 4,000 cities and villages having a population of more than 5,000 persons are on the air routes Nearly 900 cities that lack regular air services have either municipal or commercial airports of which little use is made. In 1938 air services to cities on the main airways cost the Government approximately 40 cents (1s. 7d.) per capita of the city residents in direct payments to air-mail contractors. The growing volume of mail on the present pick-up routes indicates that this service can be provided for the more than three-quarters of a million residents of the communities on the routes at an annual per capita cost of approximately 21 cents (less than 1s.).

Experience with the air pick-up and a study and analysis of operations over its two air mail routes have resulted in a proposal by All-American Aviation of a programme for the creation of a national network of mail, express and passenger transport feeder lines radiating from all major air terminals of the continental United States. The pick-up system is advocated as the only practical and economical means of furnishing expeditious air service to communities with or without airports and situated within short distances of one another.



The type of grapnel used (above) and the steel cable which is lowered from the aeroplane. On the right the type of mail containe used. It is suspended from the transfer rope by a pulley-shaped friction block.

THE ARCHBOLD EXHIBITION

BEFORE returning to the United States, Dr. Richard Archbold, the leader of the Guba expedition in Dutch New Guinea, described some of his more important naturalist finds in that country. These are interesting, the more so are the uses to which the Consolidated boat can be put in this work. Machines of this type are standard equipment in the U.S. Navy.

In all 168 flights from the coast to the interior were made over country which was otherwise impassable, carrying the necessary supplies. Radio stations were erected at the expedition's three bases so that the crew could receive the latest weather reports. Needless to say, great skill was required in operating from lakes and rivers, sometimes above 10,000ft. above sea level. Probably no other boat could have done the work, the Consolidated PBY having a remarkably good take-off and climb even at full load. Considering its performance, it has a fairly light wing-loading and low power-loading. On one occasion the expedition made a night flight during which, because of bad weather, the Consolidated had to be climbed up to 17,500ft., and even there encountered sleet, rain and snow over the Equator.

In the course of the various flights the crew saw a good deal of territory which had never been previously seen by a white man. In one large valley it was estimated that the native population was 70,000 to 80,000. None of these natives had seen white people before and all were head-hunters. Some twenty new animal species—including a giant arboreal rat four feet long, and a bird which lives in rocky country at 15,000ft.—as well as many new plants, were collected.

BUILT-IN EQUIPMENT

The Special Marconi Transmitters and Receivers for the D.H. Flamingo

IT is a good and necessary custom nowadays to consider all possible equipment in new transport aeroplanes while these are still in the design and mock-up stages. Until comparatively recently the equipment needs tended to be too vague, while production, in this country at any rate, has been too small to merit the necessary attention.

In fact, the first civil transport machine to be designed in this country for quantity production has been the De Havilland Flamingo, and in this machine the question of detailed wireless installation, among others, was duly studied, with Marconis, in the early stages.

As a result, the standard radio equipment for this machine is both more complete and compact than any previously installed, though there is no reason, of course, why individual purchasers should not have a less complete installation made up of items which are, nevertheless, part and parcel of the standard layout. This complete installation has been based on that designed for Imperial Airways' use on the Empire boats, partly because this equipment has been so satisfactory and partly because it is likely that quite a number of Flamingos will eventually be used either on these routes or on feeder lines connecting thereto. It was necessary, therefore, that the transmitters and receivers, while being installed as conventionally and compactly as possible, should be capable of dealing with short, intermediate and medium wavelengths and be installed in one compact unit. The equipment includes full direction-finding and homing facilities as well as a separate blind-approach receiver for use with normal V.H.F. beacons.

Dealing first with the normal transmitter, which can be used either with continuous waves or modulated C.W. telegraphy and telephony, its wave-range covers stages from 15-22 m. to 550-1,100 m. Immediate selection of six pre-determined wavelengths—one in each wave-range—is possible by means of a wave-selector switch, while provision is also made for the similar selection of three additional wavelengths in two longer bands. A special feature of the transmitter is that it can be used for "listening through" during both telegraphic and telephonic transmissions, while there is a "side-tone" circuit which permits the operator to hear his own messages. The necessary power is obtained from a rotary transformer.

There are two receivers. One covers a similar series of bands, though in this case there are only four of them, with a "spot" wavelength of 183 m. This is, as a matter of interest, used on the North Atlantic route and has been permanently incorporated. The fourth range (from 600 to 2,000 m.) is the most useful one. Apart from the fact that it is used for most communication purposes, it is also tuned to a direction-finding circuit, so that it provides a satisfactory standby in case of trouble with the D/F receiver.

This second receiver, which is included in the complete unit, is a combined communication and D/F set covering the wavelengths between 150 and 2,000 m. It can be used in two ways—either as a fixed-aerial homing system or, by rotating the loop, for obtaining bearings from different stations. It is possible to have both the receivers working at the same time so that the operator can use one for communication purposes while the other is being used either for homing or for D/F work. In the dashboard of the standard 95 is the latest Marconi twin-needle visual indicator, while the frame aerial, which is only 8in. in diameter, is totally enclosed in a streamlined fairing.

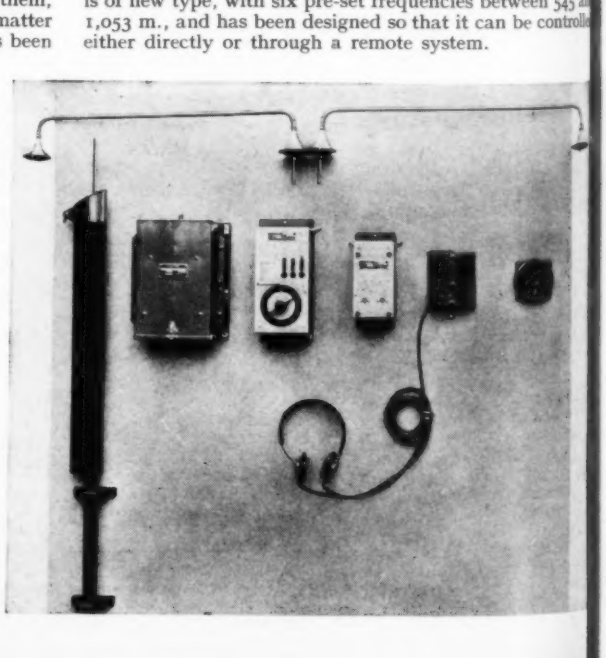
The control unit for the loop has two scales, one of them fixed and the other capable of rotation, with a pointer which revolves in step with the movement of the aerial. The fixed scale, of course, indicates bearings relative to the machine's head, while the rotatable scale can be set either to the true or magnetic course of the machine, and the operator can then read off directly the bearing of any particular transmitting stations. Within the scales is a disc designed for plotting an error correction curve. Such errors can, therefore, be read straight off.

The whole of the equipment, including all the components, parts, the rotary transformer, and the aerials, weighs less than 200 lb.

As already explained, the standard D.H. 95 is also equipped with the Marconitrack blind-approach receiver. This can be used with any standard V.H.F. beacons, and its special feature is that it has six pre-set channels for reception. Any one can, therefore, be immediately selected for use when coming in to an airport using this particular frequency for the main transmitter.

The unit equipment can be removed or replaced in a matter of minutes, and this feature has proved its value since the prototype Flamingo has been in service with Jersey Airways. Only a normal transmitter and receiver for work on medium frequencies, were required, and the other items were removed. The transmitter, incidentally, is of new type, with six pre-set frequencies between 545 and 1,053 m., and has been designed so that it can be controlled either directly or through a remote system.

(Right) The fact that there are seven units in the Marconitrack V.H.F. approach receiver equipment means that this can be conveniently installed. The wavelengths are pre-set for use at different airports.



(Left) The New Marconi enclosed loop and its remote control arrangement, with a two-ring bearing dial. The receiver for this is part of the built-in equipment described in this article.

WAR in the AIR

A Survey of the First Week's Work of British and Allied Air Forces

THE KING'S MESSAGE TO THE R.A.F.

H.M. the King on Monday, Sept., 4, sent a message to each of his fighting services. The message to the Royal Air Force was broadcast to all R.A.F. stations at Home and overseas. Its text was as follows :—

The Royal Air Force has behind it a tradition no less inspiring than those of the older Services, and in the campaign which we have now been compelled to undertake you will have to assume responsibilities far greater than those which your Service had to shoulder in the last war.

One of the gravest of them will be the safeguarding of these islands from the menace of the air. I can assure all ranks of the Air Force of my supreme confidence in their skill and courage and in their ability to meet whatever calls may be made upon them.

GEORGE R.I.

His Majesty the King visited the Fighter Command last week, and was received by the A.O.C.-in-Chief, Air Chief Marshal Sir Hugh Dowding, with whom His Majesty is seen in this picture.

A STATE of war between Britain and Germany was declared on Sunday, September 3, at 11 a.m. France declared war the same day. Poland had been already invaded by the German Army.

Many people in Britain were not aware that war would begin at that hour and had gone to church in the normal way. About 11.45, while the services were still in progress, the first air-raid warning was sounded, and about half an hour later the "all-clear" signal went. Everybody naturally thought, "Well, the Germans have not wasted much time. We expected raiding to begin even before the declaration of war. But, anyway, our Observer Corps is on the *qui vive*, and we are not likely to be taken by surprise." It was afterwards announced that a friendly aeroplane had been seen off the South Coast, and as its identity was not certain at first the warning had been sounded as a precaution.

As a matter of fact, it was not the German Luftwaffe, but the Royal Air Force which first took the air in operations against the enemy. In the very first night of the war some of our long-range machines flew over large tracts of northern and western Germany, and as they went they dropped, not bombs, but millions of leaflets, printed in German. They repeated the performance on succeeding nights, and many million leaflets were dropped. The German defences heard them, and made every effort to spot them and intercept them, but all in vain. The British crews proceeded calmly on their way, leaving everywhere visible proofs of their own abilities and of the ineffectiveness of the German air defences. It is reported that the leaflets fell in large numbers in Bremen, Bielefeld, and other towns of western Germany. On each occasion the Germans were unable to intercept our machines. The translation of the message dropped is as follows:—

German Men and Women: The Government of the Reich have, with cold deliberation, forced war upon Great Britain. They have done so knowing that it must involve mankind in a calamity worse than that of 1914. The assurances of peaceful intentions the Fuehrer gave to you and to the world in April have proved as worthless as his words at the Sportpalast last September, when he said: "We have no more territorial claims to make in Europe."

Never has government ordered subjects to their death with less excuse. This war is utterly unnecessary. Germany was in no way threatened or deprived of justice.

Was she not allowed to re-enter the Rhineland, to achieve the Anschluss, and to take back the Sudeten Germans in peace? Neither we nor any other nation would have sought to limit her advance so long as she did not violate independent non-German peoples.

Every German ambition—just to others—might have been satisfied through friendly negotiation.

President Roosevelt offered you both peace with honour and the prospect of prosperity. Instead, your rulers have condemned you to the massacre, miseries and privations of a war they cannot ever hope to win.

It is not us, but you they have deceived. For years their iron censorship has kept from you truths that even uncivilised peoples know.

It has imprisoned your minds in, as it were, a concentration camp. Otherwise they would not have dared to misrepresent the combination of peaceful peoples to secure peace as hostile encirclement.

We had no enmity against you the German people.

This censorship has also concealed from you that you have not the means to sustain protracted warfare. Despite crushing taxation, you are on the verge of bankruptcy.

Our resources and those of our Allies, in men, arms and supplies,

are immense. We are too strong to break by blows and we could wear you down inexorably.

You, the German people, can, if you will, insist on peace at any time. We also desire peace, and are prepared to conclude it with any peace-loving Government in Germany.

On other occasions portions of Mr. Chamberlain's broadcast to the German people were dropped from the air.

The fifth raid was made on the night of Friday, 8th—Saturday, 9th, and leaflets were dropped on Kassel, 185 miles south-west of Berlin. When returning some of our machines were engaged by fighters, presumed to be Belgian, and it was concluded that they had inadvertently flown across the frontier of Belgium. Evidently the air defences of that country are more efficient than those of Germany.

On Sunday, 10th, the Belgian Ministry of Defence stated that three foreign aeroplanes were chased by Belgian fighters, and gave the following account of the regrettable incident:—

"A bomber aircraft of British nationality was compelled to land. Another was surrounded by two of our chaser planes and summoned by the prescribed signals rockets and luminous bullets to come down. One Belgian plane, against which the chased plane had fired, has been destroyed. The two Belgian officers who escaped by parachutes were wounded."

The British aircraft which was compelled to land had a crew of five, and, it is stated, they have been interned. The Belgian machine which was forced down crashed near Binche, about eight miles from the French frontier near Mons. One of the occupants is stated to have had an arm broken.

The British Ambassador at Brussels was instructed to express to the Belgian Government our deep regret.

The Germans claimed that on this night a British machine crashed at Uberstedt in Thuringia, and the crew were taken prisoners.

Monday, Sept. 4. The second day of war opened with the sounding of an air raid warning just before 3 a.m. This time the explanation was that an aeroplane was seen flying high over the Midlands. Fighter machines climbed after it and found that it was a friendly machine, and then the "all clear" was sounded. These first two warnings, needless as they proved afterwards to be, were useful in getting people accustomed to taking shelter.

The Kiel Raid

The great event of this day was the raid by the R.A.F. on the German fleet at the western end of the Kiel canal. "Take the offensive," has always been the motto of our Air Force, and no time was lost in striking the first blow. A number of our bombers set off for Wilhelmshaven, and as they approached their objective the weather got very bad. The final stages were carried out in a blinding rainstorm, but the navigators made no mistake. The Germans were taken completely by surprise at such audacity. Two bombs at least scored direct hits on one of the "pocket battleships" moored in Schilling roads. Our machines were flying so low that those which followed the successful bomber were able to see the damage clearly. There are three of these pocket battleships, the *Deutschland*, the *Admiral Graf Spee*, and the *Admiral Scheer*, and they none of them have thick deck armour. The heavy bombs dropped must certainly have put this particular vessel off the active list for a considerable time to come. The Germans tried to assert that the ship in question was the *Gneisenau*, a larger battleship with thick deck armour, and that it was not damaged, but the Prime Minister has stated that one of the pocket battleships was struck.

A second warship lying off the mole at Brunsbüttel was also attacked and heavily damaged. This seems to have been the light cruiser *Emden*, a name which recalls one of the most creditable exploits of the German Navy in the last war. This new *Emden* is not likely to emulate the feats of her predecessor.

Of course these raids were not carried out with immunity. The area round Wilhelmshaven is very strong in A.A. defences, and both guns and fighters attacked our gallant bombers. The Germans claimed that five of them were shot down. The German fighters pursued them for some distance, and fighting took place above the clouds. Some bombs, the fragments of which were identified as of British manufacture, fell on and near the Danish seaport of Esbjerg, unfortunately doing some damage and causing one fatality. The British Government, in expressing its profound regret to the Danish Government, said: "From the most stringent inquiries made it is certain that no aircraft which returned was responsible, but some did not return. The attack was carried out in very bad weather, and the aircraft were subsequently engaged in combat above the clouds. One of the missing machines may, therefore, have lost its bearings and unloaded its bombs in the belief that it was over the sea."

In describing the feat to the House of Commons, the Prime Minister said, "I think it right to stress the fact that a high proportion of the officers and men in the squadrons concerned have entered the Royal Air Force and received their training since expansion began. The House may also be interested to learn that those who took part in the attack included a number who came from the Dominions." The Ministry of Information added the following remarks: "Pilots and crews returned to their bases in fine fettle. They were proud to have been chosen to strike the first blow at the German war machine. . . . The Royal Navy, in congratulating the Royal Air Force upon the great skill and gallantry displayed, is conscious of the spirit of understanding and comradeship that exists between the two Services."

A few days later H.M. the King had a conversation with the officers and airmen who had taken part in the raid.

Other incidents of the day were a report from Zürich that an explosion, accompanied by a great burst of flame, was heard and seen in the direction of the Zeppelin headquarters at Friedrichshafen.

The German Press asserted that Dutch neutrality had been violated repeatedly by British aircraft without adequate steps being taken by Holland. The Netherlands Government Press service issued a statement that only one case of this kind had been proved satisfactorily. The statement says that Dutch anti-aircraft guns in the Province of Friesland fired on an unidentified aircraft near the town of Leeuwarden, at Steins and at the Island of Ameland. The route taken by the 'plane shows that after the first shots it left Dutch territory by the shortest route.

On *Tuesday, September 5*, no activities between the British and German air forces were reported except the usual leaflet-dropping raid over Germany.

Wednesday, 6, started with an air raid warning about 6.30 a.m. Some German aircraft approached the East Coast, but did not penetrate inland, and their object remains unexplained. Our fighters went up and flew out to sea to intercept them, but the enemy were too wary to be caught. As our machines returned some A.A. gunners mistook them for the enemy and opened fire. This mistake postponed the sounding of the "All clear" until 9 a.m., when England calmly resumed the even tenor of its way. Nowhere has any sign of panic been seen. People proceeded in the most orderly way to the shelters when the warning went, and the A.R.P. and special constables did splendid work in showing them the way to the shelters. Confidence in our system of air defence is very firm, and so far the only mistakes made have been in being a trifle over-cautious. As Sir John Anderson, the Home Secretary, said, if mistakes are made it is better that they should be on the right side.

That day His Majesty the King, who has worn uniform ever since the outbreak of war, donned his uniform as a Marshal of the Royal Air Force and visited the secret headquarters of the Fighter Command. It is a fortunate coincidence that the A.O.C.-in-Chief Fighter Command, Air Chief Marshal Sir Hugh Dowding, is also the Principal Air Aide-de-Camp to His Majesty.

Allied and Enemy Air Forces

The German Army invaded Poland on Friday, Sept. 1, without any declaration of war. The German air corps immediately commenced a series of attacks on Warsaw and other Polish towns.

It will here be appropriate to record that on Wednesday, Sept. 6, Mr. Butler, Under-Secretary of State for Foreign Affairs, stated in the House of Commons, in reply to a question that the information at present in the possession

of the Foreign Office tended to show that bombing by German aircraft had been generally against objectives serving military purposes and not indiscriminately against the civilian population as such, although many casualties among the civilian population had occurred. In reply to further questions, he said that he had read in the Press that mustard gas bombs and incendiary bombs had been used, but no official reports to that effect had been received. It was his duty to give the House official information that had been confirmed, but he added that telegrams received by the Press in most cases no doubt presented a very accurate picture of what had happened.

On Monday, 4th, the Poles stated that on the Friday and Saturday there had been 1,500 civilian casualties from air raids. They said that many towns and villages far from the fighting line had been bombed, and they gave a list of between 20 and 30 towns attacked. Their sacred pilgrimage town, Czestochowa, had been bombed and set on fire, they said, on Sunday, 3rd. They claimed that in the first two days the Germans had lost 37 machines and the Poles 12. The Germans claimed to have brought down 120 Polish aircraft.

On Tuesday, 5th, the Poles claimed that near Czestochowa their aircraft had destroyed two German armoured columns. Many more German raids were reported. The Poles also asserted that German parachute-jumpers had landed behind their lines and attempted to cut telegraph and telephone lines. A private report added that some of these had been arrested in various Polish uniforms and would be shot. The Germans at first denied that any deliberate parachute drops behind the Polish lines had been made, but Field Marshal Goering admitted in his broadcast that 31 such men had been executed by the Poles.

On Wednesday, 6th, the Polish official wireless announced that 30 of their aircraft had flown over Berlin the night before, and all had returned safely. It seems that no bombs were dropped.

The Germans made a general statement that their aircraft had greatly contributed to the success of their operations, which had been carried out over difficult terrain with poor roads.

On Thursday, 7th, it became known that the Polish Government had moved from Warsaw to Lublin, some 90 miles to the South East. The Poles claimed that during a raid on Cracow they had brought down 15 German machines; while in the previous Monday's raid on Warsaw their A.A. guns had brought down seven German machines, and an eighth had fallen in a forest and was being sought for. The raiding on Warsaw continued.

On that day we heard the first news of air activity from France. French bombers had been attacking the German industrial region of the Saar, and in view of the French advance Saarbrücken had been evacuated. Reports from Belgium suggested that the French raiding had been mainly directed against the triangle Aachen (Aix le Chapelle), Eschweiler, Stolberg.

On Friday, 8th, the Poles reported that German machines had flown high over Warsaw without dropping bombs, and that six of them had been brought down. The Germans claimed to have severely damaged a bridge over the Vistula to the South of Warsaw. The Poles maintained that none of the bridges in Warsaw had been damaged.

On Saturday, 9th, the French announced that their aircraft were reconnoitring and photographing the German positions on the front between the Maginot line and the Westwall—as the Germans now call the Siegfried line.

On Monday, 11th, we heard that the French bombers were attacking concentrations of troops behind the Westwall. These were evidently the six divisions which the Germans had moved across from the eastern front.

Royal Air Force Gazette

Air Ministry, Sept. 8

Royal Air Force

General Duties Branch

The following are granted short-service commissions as Acting Pilot Officers on probation for six years on the active list (August 19):—E. R. M. Appleton, S. W. Ashton, R. B. Askquith Ellis, J. J. Barr, R. Baynes, P. E. Berry, P. D. Bowen, F. A. Bowler, J. F. B. Carey, G. C. T. Carthew, A. W. Clarke, H. G. de Forest, F. G. H. Dench, H. Downey, K. C. Dryden, H. W. Eliot, D. Evans, J. E. G. Fennell, H. C. F. Fenton, F. A. S. Fletcher, R. F. Forbes, B. L. Fox, R. C. Frost, A. V. Gifkins, G. H. Green, P. A. Haggarty, A. C. Hamman, F. N. Hargreaves, G. M. Hayton, R. A. Hubber-Richards, J. M. Jackson, M. A. Kyle, P. J. Langham, A. C. Lawson, G. J. Le Mar, A. McFadden, D. McIntosh, I. N. MacLaren, J. D. Mallinson, J. R. B. Meaker, W. G. Mellor, J. M. Milburn, W. A. Mostyn-Brown, T. A. Nixon, J. R. S. Oelofse, J. C. Paish, E. B. Panter, R. A. G. Paramore, G. Parker, N. E. Pocock, B. A. Primavesi, C. D. Rash, T. H. Rees, B. Reynolds, R. A. Rhodes, V. D. M. Roe, J. R. Rogers, D. A. A. Ross, A. C. Sargent, N. R. Selkirk, M. C. G. Sherwood, P. Sisman, J. Smith, C. M. Stavert, A. J. J. Steel, S. C. Stone, M. R. Tagg, P. R. Turgel, E. H. Upton, H. C. Upton, H. D. van der Linden, J. A. D. Wallet, J. J. Walsh, J. N. Westcott, S. G. Whiting, L. G. Williams, I. R. Wilson.

The following are granted short-service commissions as Acting Pilot Officers on probation for four years on the Active List (August 19):—J. B. Ashton, M. S. Blyth, R. J. Boret, W. D. Boxwell, R. M. Buchanan, M. F. C. Buckbarrow, C. Cookson, R. O. Day, G. W. O'N. Fisher, J. L. G. Glaister, I. P. C. Goudge, C. H. Gould, N. Green, D. G. Hayward, C. A. Hobson, D. H. F. Horner, J. L. Maude-Roxey, R. E. Maurer, W. P. Olesen, C. Orme, W. P. H. Rafter, M. Rowell, R. D. Rutter, R. E. Shaw, H. J. C. Tudge, E. O. Walsh, G. P. Welman.

The following Pilot Officers on probation are confirmed in their appointments on the dates stated:—

A. J. S. Pattinson (July 20); O. B. Morrogh-Ryan, E. W. Whitaker (August 20); D. M. B. Druce, J. D. Young (August 22).

The following Acting Pilot Officers on probation are confirmed in their appointments and graded as Pilot Officers on the dates stated:—

W. O. D. Tweddell (March 7); I. R. Gow, M. H. G. Rawlinson (April 4); L. D. Foley, R. W. Hayes, D. Murray (June 27); E. W. M. Heale (August 5); G. L. R. J. Ansell, L. H. Childe, R. L. Cox, L. B. Emeno, A. G. Espley, T. R. Fox, E. I. Hewett, E. C. Lenton, A. J. G. Mills, J. Palmer-Samborne, F. G. Potts, R. H. Thomas, W. F. Tudhope (July 25); G. B. S. Agar, C. I. R. Arthur, D. J. Bain, L. M. Blanckensee, R. J. E. Boulding, V. M. Bright, K. Brooke-Taylor, G. Cox Campbell, F. L. Campbell-Rogers, R. K. Cassels, R. S. A. Churchill, J. Clayton, J. H. H. Copeman, J. J. H. Copley, N. G. Cranna, R. G. Cuthbert, A. P. Davis, E. Dawes, R. L. F. Day, I. H. Dolman, R. F. Donati, T. R. A. Dow, J. J. Drummond, L. E. Duke, N. N. H. Dunlop, A. M. Edgar, W. E. Edser, A. Elson, K. P. English, L. J. E. Ewing, H. E. M. Featherstone, J. T. T. Fleming, A. M. Foster, P. S. Foy, R. A. Givens, A. B. Goldie, G. D. Goldsmith Jones, J. A. Gordon, C. E. Greenwell, K. P. Hamilton, M. T. Harries, A. H. Hayter, R. F. Inness, J. M. H. Jewell, R. T. Kean, W. E. N. Keller, F. T. Lampen, R. O. Lawry, E. G. Libbey, D. Lingwood, D. U. Lowson, W. D. G. McCaw, K. H. Nash, H. F. O'Neill, R. E. Orchard, H. C. S. Page, C. O. J. Pegge, A. F. Posselt, J. D. T. Pritchard, C. C. Proby, C. S. Robson, G. W. Salzgeber, P. N. Screeton, J. W. Smith, P. D. B. Stevens, A. Stewart, A. Thomas, C. R. Tufford, B. L. Watkin, C. L. Wilson, P. R. Wylde (August 29).

Acting Pilot Officer on probation P. R. St. Quintin is confirmed in his appointment and graded as Pilot Officer (April 4). (Substituted for notification in *Gazette* of June 9.)

The following Acting Pilot Officers on probation are graded as Pilot Officers on probation on the dates stated:—A. R. Densham (July 25); S. Baker, W. G. Bibby, J. H. Grimes, A. Hughes, P. J. C. King, J. A. Woollen (August 29).

The following Flying Officers are promoted to the rank of Flight Lieutenant on the dates stated:—M. P. Skinner (Acting Flight Lieutenant); F. R. Foster (June 14); G. P. Harger, A. T. Irvine (seniority May 1) (August 1); J. C. McG. Lunn, D. Davies (August 16).

The following Pilot Officers are promoted to the rank of Flying Officer on the dates stated:—J. D. Tillott (June 16); J. R. T. Smalley, G. H. Smith (July 12); H. R. A. de Belleroche, E. J. T. Clarke (July 16); D. D. Pryde, A. H. C. Cox, E. J. P. Jackson (July 21); R. H. Bullard-Davies, G. P. Miers, L. T. Wallis (August 16); S. D. P. Connors (August 19); D. W. Stannard, M. L. Gaine, A.F.C.; R. E. Drake, F. Gomersall, H. Ledger, S. Wroath, W. J. Carr, W. B. Goddard (August 24); T. M. W. Smith, T. B. Marshall, L. Ereminsky, A. J. Hannigan (September 1).

Group Capt. R. L. G. Marix, D.S.O., is granted the acting rank of Air Commodore (unpaid) (August 23).

The following Flying Officers are granted the acting rank of Flight Lieutenant on the dates stated:—L. G. Schwab (April 27); L. E. Abel (May 31); K. F. Arnold (June 5); G. D. Jones (July 12); P. F. Webster, S. C. Pendred (July 14); W. Townson (July 20); G. W. C. Gleed (July 24); H. C. Sammels (July 27); E. J. S. Jones (July 30); P. W. Dawson (August 4); B. G. D. Nathan (August 5); P. H. Rebbeck, M. N. Crossley, H. C. Marshall (August 7); R. L. Smith, J. Rankin, A. J. Elliott (August 8).

The following Pilot Officers are granted the acting rank of Flight Lieutenant on the dates stated:—E. L. Ford (July 11); R. G. Maddox (July 31); F. E. W. Birchfield (August 8); I. MacLeod-Selkirk, J. E. A. Williams (August 14).

It is regretted that it is necessary to hold over from this issue the remainder of the "Gazette," dated September 8.

The Short-Mayo Composite. The upper and lower components are Mercury and Maia respectively.

TRANS-ATLANTIC AIR SERVICES

The Technical Aspects Examined in Paper to the British Association

By MAJOR R. H. MAYO, O.B.E., M.A., M.I.C.E., F.R.Ae.S.

AS is his custom when he gets up to speak, Major Mayo did not mince words. One of his first remarks was, "It seems to me that there has been more nonsense talked and written about trans-Atlantic air services than about most aspects of aviation, and that is saying a good deal." He then referred to cocktail bars and dance halls on "giant air liners," and said that even governments concerned in finding the money for trans-Atlantic air services seemed to have been effected by this attitude. He complained that there seemed to have been no definite policy.

Major Mayo then outlined the history of past trans-Atlantic flights, from the earliest crossings by the American flying boats under Commander Read, and the flight by Alcock and Brown, to this year's experimental scheduled flights. "And so," Major Mayo continued, "the Atlantic has yielded a little, but is still very far from being conquered. The stage has not yet been reached when an attack during the winter months can be attempted, and much remains to be done before that stage can be reached. Complete success will not have been achieved until a reliable, regular and frequent all-the-year-round service has been established. No one is really qualified to predict how long that will take. If I had to make a forecast it would not be less than another ten years."

Alternative Routes

In reviewing the different alternative routes Major Mayo referred to the freezing of Botwood in winter; the absence of an aerodrome at Bermuda; the impossibility of finding sheltered harbours in the Azores, and the difficulties of providing aerodromes in those mountainous islands. Of the marine base on the Shannon in the west of Eire Major Mayo said that it reduced the distance to Newfoundland by 350 miles as compared with Southampton which "is quite unsuitable and with the best will in the world cannot be made suitable, owing to congestion of shipping."

Major Mayo next surveyed the lengths of stages and total distances involved in the various alternative routes across the Atlantic. He pointed out that it was necessary to consider both Montreal and New York as Western terminals because it must be our purpose both to complete the chain of Empire air communications and to participate in the development of services over the great traffic route between New York and Europe. In the table Southampton was taken as the British terminal base, not because it would necessarily be the base for landplanes, but the distances would not be substantially different for an alternative base nearer to London.

(1) Southampton—Montreal Routes

Route	No. of Stages	Longest Stage	Total Distance
		(miles)	(miles)
Southampton—Montreal direct	1	3,200	3,200
Southampton—Foynes—Botwood—Montreal ...	3	2,000	3,230
Southampton—Horta—Bermuda—New York—Montreal	4	2,070	4,750
Southampton—Lisbon—Horta—Bermuda—New York—Montreal	5	2,070	5,200
Southampton—Horta—Botwood—Montreal ...	3	1,575	3,970

(2) Southampton—New York Routes

Route	No. of Stages	Longest Stage	Total Distance
		(miles)	(miles)
Southampton—New York direct	1	3,400	3,400
Southampton—Foynes—Botwood—New York ...	3	2,000	3,420
Southampton—Foynes—Botwood—Montreal—New York	4	2,000	3,550
Southampton—Horta—Bermuda—New York ...	3	2,070	4,420
Southampton—Lisbon—Horta—Bermuda—New York	4	2,070	4,850
Southampton—Horta—Botwood—New York ...	3	1,575	4,150

On the route to Newfoundland it was particularly important to have an alternative base when the ordinary became unserviceable in winter. Difficulty was likely to arise in the regular operation of landplanes to Hattis Camp during the winter months. The Azores-Bermuda route would offer a good alternative for winter operations, the maximum stage being substantially the same as that of the northerly route. Unfortunately, harbour facilities were not available at the Azores. This difficulty of lack of facilities was a bar to the establishment of a regular service from Southampton to Montreal or New York via the Azores and Newfoundland. This was unfortunate because the maximum stage of this route was only 1,575 miles compared

with the 2,000 miles of the Foynes-Botwood route and 2,070 miles of the Azores-Bermuda route.

These considerations pointed to the outstanding advantage of providing the aircraft with sufficient range for the direct crossing from Southampton to Montreal or New York. The provision of this range presented formidable problems to the designer, but Major Mayo thought that it could be done and that only by doing it could a really successful Atlantic service be established.

Even if the necessary range was provided for the direct flight, marine aircraft would be at a disadvantage in winter conditions because Montreal was put out of action by ice and even New York was not immune. The period during which New York was likely to be out of action was comparatively short and it might become possible to stretch the range by the further 200 miles needed to reach Baltimore which remained open.

Among the difficulties of regular operation over the North Atlantic during the winter, Major Mayo mentioned that it was certain that very strong winds would have to be faced and it seemed reasonably certain that severe icing conditions would be prevalent. It would only be justifiable to face these conditions if in addition to adequate safeguards against icing a very ample margin of range had been provided.

Major Mayo referred briefly to the scheme of stationing floating islands or seadromes in the Atlantic. He said the scheme proved impracticable for financial and other reasons and could not be seriously considered.

Nature of Services

On the subject of the nature of service required Major Mayo said that a passenger air service across the Atlantic could not hope to offer comfort comparable with that of liners like the Queen Mary and would have to make up for this by a very substantial saving in time. He thought there would be comparatively few passengers who would be prepared to sacrifice the amenities of ocean travel unless the air service would get them across safely in 24 hours. In the case of mails the air service would have to cut down the time to something like an overnight service in order to compete.

In addition to high speed, it would also be necessary to provide high frequency. The aim for the Atlantic should be a daily overnight mail service between London and Montreal and New York.

Passengers, Major Mayo said, expected to get the highest standard of comfort, but they did not expect to pay for it, and the deficience had to be made up by subsidies. The carriage of passengers was vastly more costly than the carriage of mails. To the average weight per passenger of 165 lb. must be added an allowance for luggage, and if the weight of necessary equipment and furnishing was taken into account, as it must be, the average effective weight per passenger was at least 500 lb. The limiting weight of half an ounce for an air mail letter meant 40 to the pound, and that was equivalent to 20,000 letters for the weight of one passenger and the equipment needed to carry him in comfort. The charge on the present experimental Atlantic air service was 1s. 3d. per half-ounce letter. That was equivalent to a fare of £1,250, a figure which might be reduced by increased volume of traffic, but which did show that passenger traffic was relatively unprofitable.

The primary function of subsidised air transport should, Major Mayo said, be the provision of high-speed mail services at rates which came within the means of the population as a whole. If that principle were admitted it was hard to avoid the conclusion that passengers and mails should be segrated. That led to the selection of the smallest possible aircraft which would carry the mail load, flying at high speed and operating at high frequency. The passenger aircraft could be slower, of larger size, and could operate at lower frequency.

It would be several years before the standard of safety which could be assured during the winter months could be such as to justify the carriage of passengers. The same did not apply to mails because flying personnel could be called upon to face greater risks than those to which a passenger could legitimately be subjected. If passenger services were to be suspended during the winter months, it was better that the mail services which were continued should be based on the most suitable and economic type of aircraft. The highest possible speed was not only desirable for the mails. It served to reduce the physical strain on the personnel.

Because it materially affected the type of aircraft required, Major Mayo examined the question of whether the Atlantic air mail should be based on a surcharge, or should be, like the Empire scheme, an "all-up" mail. He pointed out that the annual mail between Great Britain and Canada and the United States amounted to about 800 tons westgoing and 650 tons eastgoing. In the case of Canada only the figures were 325 tons and 215 tons. A daily service throughout the year would thus call for about a ton capacity. The subsidies required would be very high, and he thought a strong case could be made out for adopting the surcharge scheme.

The Atlantic air mail would reduce the time to approximately that taken by night letter telegram. On the basis of a surcharge of 1s. per half-ounce letter the service would be much better than that offered by night letter telegram and might attract between 5 per cent. and 10 per cent. of the present first-class mail. On that basis provision would have to be made for one and a half tons a week in each direction. With a daily service that would mean a capacity of 500 lb. per service, and aircraft designed to carry 1,000 lb. of pay load would provide a good margin. Expressed as 20,000 letters this pay load of 500 lb. represented £1,000 of revenue per trip.

Design Considerations

Starting with the assumption that the range provided must be that between Southampton and Montreal or New York, and that a westerly wind of 40 m.p.h. would have to be allowed for, Major Mayo turned to the question of speed, which he had already defined as the greatest possible so as to give an overnight service. The prevailing wind was against the westgoing crossing, but the difference in time was in favour of it. In the opposite direction the reverse was the case. Of the two, the difference in time was, somewhat surprisingly, the more important. The effect of the two cases was set out in the following table, which was based on the 3,400 miles of the Southampton-New York stage. It should be pointed out that an adverse westerly wind of 40 m.p.h. has been assumed, and a following wind homeward bound of 20 m.p.h.

Stage	Cruising Speed	Net Cruising Speed	Actual Time	Effective Time
			(hrs.)	(hrs.)
Southampton—New York ...	150	110	31.0	26.0
	156	116	29.3	24.3
	200	160	21.3	16.3
	250	210	16.2	11.2
	300	260	13.1	8.1
	350	310	11.0	6.0
New York—Southampton ...	150	170	20.0	25.0
	156	176	19.3	24.3
	200	220	15.5	20.5
	250	270	12.6	17.6
	300	320	10.6	15.6
	350	370	9.2	14.2

Equality of scheduled times for the easterly and westerly crossings occur at a cruising speed of 156 m.p.h. Major Mayo thought much higher cruising speeds would be necessary, and so the criterion for minimum cruising speed became the maximum effective time which could be allocated for the easterly service. At a cruising speed of 300 m.p.h., and allowing two hours at each end for collection and delivery, a letter posted in New York at 5 p.m. could be delivered in London at 12.30 p.m. on the following day. In the opposite direction the effective time was only 8.1 hours, and a letter posted in London up to 8 p.m. could be delivered in New York at 8 a.m. of the next day. Even at a cruising speed of 350 m.p.h. it was not possible to attain early-morning delivery in London, and that cruising speed was not practicable at present.

For passengers it would not be economical to cruise at such high speeds, because of the large size of aircraft and the degree of comfort demanded. A cruising speed of 200 m.p.h. gave the time of flight of 21.3 hours, which was probably as long as most passengers would care to stand.

Turning to detail design, Major Mayo pointed out that if the full requirements of cruising speed, range and pay-

load were to be met it would be necessary to increase initial wing loadings to something like 50 lb./sq. ft. In order to enable most of the flight to be made at the best L/D ratio even higher wing loadings would be desirable, but considerations of landing speed at the end of the flight made 50 about the maximum loading practicable. That represented a loading at the end of the flight of about 30 lb./sq. ft.

Raising the wing loading at the sacrifice of take-off performance was the easy way of increasing range and cruising speed of long-range aircraft. The highest-loaded British commercial aircraft, a flying boat, had been taken off at a loading of 33.7 lb./sq. ft., but required good surface conditions.

Up to the present there was no British commercial landplane in service employing a greater wing loading than about 30 lb./sq. ft. He thought a landplane designed as a mail carrier only and carrying a pay-load of 1,000 lb. would have to run to a total weight of between 60,000 and 70,000 lb. in order to meet performance requirements. He did not think marine type aircraft could reach the desired cruising speed but it could meet the range and load requirements at a lower speed, and would have a loaded weight of between 70,000 and 80,000 lb.

Major Mayo made the interesting observation that, from the safety point of view, there was little to choose between the landplane and the flying boat. Even the largest flying boat was not likely to be able to keep afloat in average Atlantic conditions. Safety could only be achieved by eliminating the forced landing. He thought the landplane might be used for carrying mails and the flying boat for passengers, but based this view on considerations other than safety.

Assisted Take-off

The next section of Major Mayo's paper dealt with assisted take-off. He surveyed what has been done with the catapult, the composite, and the system of refuelling in flight after the take-off. As these have been described and commented on repeatedly in *Flight*, we need not repeat this section of the paper beyond pointing out his general conclusions.

The most obvious drawback to catapult launching was that it got the machine into the air at sea level at a speed not much in excess of stalling speed, so that the aircraft was in a precarious position in case there was a loss of power soon after the take-off. With flight refuelling he did not think it could yet be assumed that this could be successfully applied to aircraft with the wing loadings necessary for economical Atlantic flight. Moreover, practical operational difficulties were increased by the necessity to start the Atlantic flights at night.

The advantages of the composite aircraft scheme were outlined and summarised by Major Mayo as follows:—

(1) It eliminates the take-off problem for heavily loaded aircraft. It provides for a quick take-off and a short run and thus dispenses with the necessity for special airports or large stretches of sheltered water.

(2) It launches the heavily loaded aircraft at a safe height and at a safe speed far above the stalling speed. By doing this it eliminates the risk of crashing due to engine or other trouble at or soon after the take-off.

(3) It relieves the engines of the long-range aircraft of the heavy strain associated with direct take-off and initial climb, and thus makes for engine reliability.

(4) It enables the smallest and most economic size of aircraft to be employed and is thus particularly well adapted for long-range mail services.

(5) It offers scope for the effective use of compression-ignition engines. The one serious drawback to these engines in normal practice is the lack of excess power for take-off, but this does not matter in the case of the composite aircraft.

(6) It is particularly suitable for launching an aircraft which has been specially designed to take advantage of stratosphere or high-altitude flying.

(7) It offers a high degree of mobility; the auxiliary aircraft (the lower component) can fly from base to base and a standard dock or builders' crane can be used for the operation of mounting.

(8) Obsolescent aircraft of moderately large size can be adapted with comparatively little modification to form suitable lower components.

(9) The capital and operating costs of the auxiliary aircraft and equipment are comparatively small in relation to the great reduction in capital and operating costs effected.

(10) It has demonstrated its suitability for operation in varying weather conditions and is in principle suitable for night operations.

(11) It is the only method of assisted take-off which has been successfully demonstrated for the launching of a very heavily loaded aircraft.

Major Mayo also had some interesting comments to make on stratosphere flying. It might be taken, he said, that the gain to be expected from supercharging the engines and increasing the height would increase the available cruising speed at the rate of about 1.5 m.p.h. per 1,000ft. of altitude.

Meteorologists had already estimated that prevailing westerly winds increased at the average rate of 2 m.p.h. per 1,000ft. of altitude, so that for the westerly crossing increasing the operational height would only mean loss of net speed. Also there were operational objections to compelling pilots to fly at a predetermined height across the Atlantic.

The Unitwin Goes Ahead

CONSIDERABLE extensions have been made at the Vega Airplane Company's works in order to deal with the production of the new Starliner.

This, it may be remembered, is the first machine to be fitted with the Unitwin engine—two six-in-line Menascos geared through a clutch mechanism to a single constant-speed airscrew and consequently offering the advantages of a twin-engined layout with none of the disadvantages.

The Starliner, ten of which are in process of construction, is a low-wing monoplane six-seater with a tricycle undercarriage. The total power is 520 h.p. and the cruising speed is 184 m.p.h.

Tests of the prototype are to be carried out by Mid-Continent Airlines on the route between Kansas City and Tulsa after the Civil Aeronautics Authority has passed it out.

An Elongated Pratt and Whitney

IN view of the fact that one engine of the Pratt and Whitney range is already known as the Twin Wasp the introduction of a new unit designated the Double Wasp is somewhat confusing. The new engine, however, is much more powerful than the Twin Wasp and is of unique design. It is an 18-cylinder air-cooled two-row radial of small diameter, but of unusual length. The power is given as 1,600 h.p. at over 20,000ft., and it may reasonably be assumed that a two-speed supercharger is used.

According to a statement by Mr. Leonard S. Hobbs, engineering manager of Pratt and Whitney Aircraft, the theoretical power (French *équivalent de puissance*) is more than 3,000 h.p. at sea level.

The installation is extremely neat, there being only a small annular inlet for the cooling air. Controllable gills of normal design are fitted round the training edge of the cowling, while in front is a large inner cowling which is virtually a fairing behind the spinner. A three-bladed Hamilton Hydromatic airscrew is fitted on the engine which is now on show at the World's Fair in New York.

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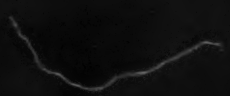
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